V.

A Comparison of the Harvard College Observatory Catalogue of Stars for 1875.0 *with the Fundamental Systems of Auwers, Safford, Boss, and Newcomb.*

BY WILLIAM A. ROGERS.

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SINCE the actual construction of the catalogue of stars found in Volume XII. of the "Annals of Harvard College Observatory," five catalogues of the principal stars of the heavens have been independently formed; for the most part from complete discussions of all the data available previous to the year 1872. I name them in the order of their publication.

(*a*) Fundamental-Catalog für die Zonen-Beobachtungen am nördlichen Himmel; herausgegeben im Auftrage der Zonen-Commission der astronomischen Gesellschaft.

VON A. AUWERS.

(*b*) U. S. Geographical Surveys. Lieut. Geo. M. Wheeler, Corps of Engineers, in charge. Catalogue of 2018 Stars for Jan. 1, 1875.

By T. H. SAFFORD, PH.D.

(*c*) U. S. Northern Boundary Commission. Declinations of Fixed Stars.

By LEWIS BOSS,
Director, Dudley Observatory.

(*d*) Catalogue of 1098 Standard Clock and Zodiacal Stars, prepared under the direction of

SIMON NEWCOMB,
Professor U. S. N., Superintendent American Ephemeris.

(*e*) Verzeichniss von 83 südlichen Sternen zur Fortsetzung des Fundamental-Catalogs für die Zonen-beobachtungen am Nordhimmel bis zum 31. Grade südlicher Declination.

VON A. AUWERS.

The first of these catalogues contains the positions of 539 stars, symmetrically distributed over the entire heavens as far as 10° south declination. The authorities upon which the coördinates of these stars depend are as follows: —

Pulkowa	1845
Pulkowa	1865
Pulkowa	1871
Greenwich	1836 – 1876
Harvard College	1871 – 2
[1] Leipsic	1866 – 1870
Leiden	1864 – 1870

The fifth catalogue of the series is to be regarded as a continuation of the first. It depends upon the same authorities as the first, with the addition of the following: —

Cape of Good Hope	1860
Williamstown	1861 – 1863
Melbourne	1870
Safford; Harvard College Observations	1862 – 1865
Yarnall	General Catalogue.
Washington	1872 – 1875

The proper motions of the catalogue of 539 stars depend upon a comparison of the modern observations with the unpublished coördinates resulting from a re-discussion of Bradley's observations, by Dr. Auwers.

The catalogue of Safford extends from 12 hours to 2 hours of right ascension. Since the field operations of the survey by Lieutenant Wheeler were limited to the summer and autumn months, it was necessary to include in the catalogue only such stars as could be made available in this work. The positions given, rest upon the available authorities between 1755 and 1875. The right ascensions are given to hundredths of seconds of time, and the declinations to tenths of seconds of arc. The author considers the right ascensions as provisional only (Introduction, p. 9), but it will be seen hereafter that the agreement with the fundamental system of Auwers is, with a very few exceptions, good, after the systematic differences between the two systems have been applied. For the most part, Mädler's values of the proper motion were employed in the reductions in right ascension. The proper motions in declination depend upon Auwers-Bradley, Piazzi, and Groombridge combined with the modern observations. Bessel's constants of precession were used in the reductions.

[1] In declination only.

The catalogue of Boss gives the exact coördinate in declination only, the right ascension being given only to tenths of seconds of time. The observations of Bessel, 1821, of Struve, 1824, and of Argelander, 1829, combined with modern observations, form the basis of this admirable system of declinations. The author has given an elaborate discussion of the systematic corrections of each catalogue employed when referred to this normal system, and from these corrected positions the present catalogue was constructed. The departure from the usual practice of assuming Bradley's observations for 1755 as absolute, in the determination of proper motions, will not meet with universal approval; but there are many reasons which may be given in its favor. It may be safely assumed that the normal system constructed by Professor Boss fairly represents the observations of Bessel, Struve, and Argelander. When, therefore, we find that the proper motions derived from this normal system differ systematically from those derived from the Auwers-Bradley positions, we may conclude that there is an inherent discordance between the two systems. Without attempting to decide which is correct, it is well worth while to be able to establish the fact of the discordance, since it bears a close relation to the questions of precession, of proper motion, and of the motion of the solar system in space.

With reference to the formation of this normal system the author says:—

"It will be shown that the interval of time between the group of early determinations by Bessel (1821), Struve (1824), and Argelander (1829), and the later ones at Leiden, Melbourne, Greenwich, and Washington observatories (not to mention intermediate catalogues), is quite sufficient for an independent judgment as to the approximate accuracy and consequent weight of Bradley's results, and that a reliable system of corrections to the various catalogues may be founded on a discussion of recent catalogues alone, taking as the earliest that of Bessel for the mean epoch 1821."

Struve's constants of precession were used throughout in the formation of this catalogue.

The catalogue of Newcomb was constructed mainly "for the purpose of obtaining standard positions of reference stars for use in the lunar and planetary theories, especially in the reduction of the older occultations." The right ascensions are referred to the author's fundamental system of equatorial stars published in the appendix to the Washington Observations for 1870. The right ascensions of the polar stars are taken without change from Dr. Gould's discussion in 1861. The declinations are referred to the system of Boss. Struve's constants of precession were employed in the reductions.

The Harvard College Observations for 1871–2, published in Vol. X. of the Annals of the Observatory, extend from April 26, 1871, to May 22, 1872. They depend upon the places of the first or the provisional catalogue of 539 stars published in

1869 [Vierteljahrsschrift der astronomischen Gesellschaft, 1869, pp. 324–349]. This catalogue consists of 336 principal stars, whose positions were at that time known within narrow limits, and of 203 secondary stars whose places were known with less precision. These two catalogues, however, form a nearly homogeneous system.

The catalogue for 1875, published in Vol. XII. of the Annals was constructed from the catalogue in Vol. X., combined with two series of observations made during the years 1874 and 1875. It is to be noted, however, that these two catalogues are not strictly comparable. The Pulkowa observations of the "Zusatzsterne" were published by Professor Struve in 1874 [Vol. IX., pp. 83–88, "Vierteljahrsschrift der astronomischen Gesellschaft"]. Under the supposition that the corrections to the provisional places given in this publication were to be employed in the reduction of the zone observations, they were used in the reductions of the Harvard College observations for 1874 and 1875. But it will appear from the table given below that the systematic deviation of the Pulkowa observations from the final positions of the same stars given in Publication XIV. of the Gessellschaft, are quite large, especially in declination. In so far, therefore, as these stars were used in the determination of the instrumental constants for the years 1874 and 1875, there is a departure from the system upon which the catalogue for 1872 is based.

Designating the entire provisional catalogue by P and the stars of this catalogue which were used in the reduction of the Harvard College Observations by P' we have the following relations between Auwers, Struve P and P'. In the comparison with P' *all* the stars of the list are included, but in the comparison with P, 18 stars in right ascension and 8 stars in declination were omitted on account of the magnitude of the residuals: —

δ	Auwers *minus* P.		Auwers *minus* P′.		Auwers *minus* Struve.	
	$\Delta\alpha$	$\Delta\delta$	$\Delta\alpha$	$\Delta\delta$	$\Delta\alpha$	$\Delta\delta$
° °	s.	″	s.	″	s.	″
−10 . . . + 0	+.004	+0.13	+.001	+0.13	+.016	−0.23
+ 0 . . . +10	+.014	+ .21	+.014	+ .21	+.006	+ .26
+10 . . . +20	+.016	− .03	+.019	− .04	+.025	+ .16
+20 . . . +30	+.010	+ .09	+.012	+ .12	+.024	+ .36
+30 . . . +40	+.036	+ .02	+.039	+ .00	+.038	+ .79
+40 . . . +50	+.050	+ .30	+.054	+ .34	+.039	+ .50
+50 . . . +60	+.030	+ .60	+.049	+ .58	+.045	+ .58
+60 . . . +70	+.064	+ .51	+.065	+ .53	+.031	+ .34
+70 . . . +85	+.067	+ .45	+.066	+ .48	+.025	+ .00

The corrections given above may be assumed to be true for the mean declination of the group to which they belong, and for twelve hours of right ascension. It is

apparent, however, from the following comparison of Auwers with P' that the correction belonging to any group cannot be regarded as constant for every right ascension of that group.

Auwers *minus* P.

R. A.	Δα								
	−10°...+0°	+0°...+10°	+10°...+20°	+20°...+30°	+30°...+40°	+40°...+50°	+50°...+60°	+60°...+70°	+70°...+85°
h. h.	s.	s.	s.	s.	s.	s.	s.	s.	s.
0 ... 6	−.011	+.014	+.010	+.011	+.039	+.046	+.027	+.117	+.162
6 ... 12	+.011	+.014	+.010	+.014	+.061	+.062	−.008	+.096	+.052
12 ... 18	+.003	+.007	+.031	+.000	−.009	+.081	+.069	−.016	+.036
18 ... 24	+.019	+.021	+.021	+.017	+.069	+.043	+.097	+.044	+.027
	Δδ								
	″	″	″	″	″	″	″	″	″
0 ... 6	+0.19	+0.44	−0.13	+0.25	−0.11	+0.31	+0.74	+0.30	+0.40
6 ... 12	+ .55	+ .39	+ .26	+ .26	+ .14	+ .74	+ .93	+ .88	+ .65
12 ... 18	− .14	− .13	− .14	− .10	− .12	+ .06	+ .46	+ .29	+ .43
18 ... 24	− .06	+ .00	− .09	+ .01	+ .11	+ .35	+ .25	+ .73	+ .47

Data for the Reductions to the System of Auwers.

δ	Auwers *minus* Harv. Coll.		Auwers *minus* Safford.		Auwers *minus* Boss.	Auwers *minus* Newcomb.	
	Δα	Δδ	Δα	Δδ	Δδ	Δα	Δδ
°. °.	s	″	s.	″	″	s.	″
−31 ... −25	−.037	−1.07	....	....	....	−.005	−0.70
−31 ... −20	−.027	− .73	....	....	−0.72	−.010	− .71
−25 ... −15	−.014	− .38	....	....	....	−.001	− .64
−20 ... −10	−.020	+ .20	....	....	− .49	+.003	− .55
−15 ... − 5	−.007	+ .38	....	....	....	+.000	− .39
−10 ... + 0	−.010	+ .41	....	....	− .24	−.005	− .25
− 5 ... + 5	−.015	+ .19	....	....	....	−.012	− .12
+ 0 ... +10	+.007	− .07	....	....	− .16	−.005	− .11
+ 5 ... +15	+.016	+ .11	+.037	−0.39	....	−.006	− .19
+10 ... +20	+.012	+ .26	+.034	− .37	− .21	−.004	− .20
+15 ... +25	+.019	+ .30	+.025	− .31	....	+.000	− .14
+20 ... +30	+.033	+ .17	+.029	− .25	− .01	−.004	− .07
+25 ... +35	+.037	+ .09	+.028	− .28	....	−.005	− .06
+30 ... +40	+.035	+ .15	+.016	− .24	− .05	−.008	+ .01
+35 ... +45	+.039	+ .23	+.029	− .23	....	−.005	+ .00
+40 ... +50	+.046	+ .28	+.044	− .11	− .07	−.006	+ .05
+45 ... +55	+.050	+ .04	+.052	+ .00	....	−.006	+ .07
+50 ... +60	+.034	+ .03	+.037	+ .18	+ .04	−.007	+ .08
+55 ... +65	+.025	+ .24	+.031	+ .25	....	+.030	+ .06
+60 ... +70	+.048	+ .35	+.038	+ .27	+ .07	+.057	+ .10
+65 ... +75	+.057	+ .38	+.041	+ .25	....	+.044	+ .11
+70 ... +85	+.042	+ .13	....	....	+ .12	−.032	+ .09
+75 ... +85	+.017	− .04	....	....	....	−.077	+ .10

The corrected residuals, in the case of Safford, in declination, of Boss and of Newcomb, are so nearly constant, for each group, when arranged in the order of declination, that it may be safely assumed that they are not a function of the right ascension. In the case of Harvard College and of Safford, in right ascension, the evidence is decisive that the residuals in certain groups vary with the right ascension. This is to be expected in the case of the Harvard College observations, since the deviations of the fundamental system upon which they depend, from the system of publication XIX. are functions both of the declination and of the right ascension. The provisional catalogue designated P is based upon Bessel's constants of precession. The same remark applies to Safford's catalogue. For the conversion from the constants of Bessel to those of Struve, we have the following relations between the annual variations in α and δ for 1875.0 :—

$$\text{Struve} = \text{Bessel} + \overset{s}{.001123} + \overset{s.}{.000129} \tan\delta \sin\alpha.$$

$$\text{Struve} = \text{Bessel} + \overset{\prime\prime}{.00194} \cos\alpha.$$

It will be seen from these relations that the change in the right ascension in a century may be as great as $0^s.11$ for a star on the equator, while the change in declination will be insignificant, the maximum value being only $0''.19$. It is also apparent that the residuals, especially in right ascension in the column Auwers *minus* P, are for the most part due to the change from the constants of Bessel to those of Struve.

For the more complete reduction to the system of Auwers, we have the following additional data.

AUWERS *minus* HARVARD COLLEGE.

δ	$0^h \ldots 6^h$		$6^h \ldots 12^h$		$12^h \ldots 18^h$		$18^h \ldots 24^h$	
	$\Delta\alpha$	$\Delta\delta$	$\Delta\alpha$	$\Delta\delta$	$\Delta\alpha$	$\Delta\delta$	$\Delta\alpha$	$\Delta\delta$
° °	s	″	s.	″	s.	″	s.	″
−31 ... −25	−.037	−1.07	−.037	−1.07	−.037	−1.07	−.037	−1.07
−31 ... −20	−.058	− .77	−.004	− .16	−.010	−1.19	−.021	− .90
−25 ... −15	−.045	− .63	−.014	− .03	+.005	− .60	−.018	− .35
−20 ... −10	−.046	− .09	−.026	− .31	+.002	− .32	−.014	− .10
−15 ... − 5	−.015	+ .46	−.027	+ .08	−.005	+ .25	+.005	+ .67
−10 ... + 0	−.007	+ .31	−.026	+ .76	−.002	+ .25	−.006	+ .37
− 5 ... + 5	−.017	+ .07	+.000	+ .53	−.015	+ .38	−.017	+ .01
+ 0 ... +10	+.007	− .36	+.023	+ .15	−.003	+ .34	−.007	− .49
+ 5 ... +15	+.017	− .02	+.026	+ .32	−.010	+ .04	+.018	− .06
+10 ... +20	+.009	+ .32	+.019	+ .72	+.000	+ .05	+.020	+ .15
+15 ... +25	+.009	+ .32	+.015	+ .66	+.008	+ .02	+.043	+ .08
+20 ... +30	+.024	+ .17	+.015	+ .54	+.041	+ .03	+.052	− .02

AUWERS *minus* HARVARD COLLEGE. — Continued.

δ	$0^h \ldots 6^h$		$6^h \ldots 12^h$		$12^h \ldots 18^h$		$18^h \ldots 24^h$	
	$\Delta\alpha$	$\Delta\delta$	$\Delta\alpha$	$\Delta\delta$	$\Delta\alpha$	$\Delta\delta$	$\Delta\alpha$	$\Delta\delta$
° °	s.	″	s.	″	s.	″	s.	″
+25 . . . +35	+.044	+ .11	+.023	+ .29	+.038	+ .05	+.038	— .08
+30 . . . +40	+.028	+ .15	+.027	+ .47	+.036	— .11	+.061	+ .02
+35 . . . +45	+.025	+ .22	+.047	+ .56	+.032	— .14	+.055	+ .34
+40 . . . +50	+.043	+ .25	+.051	+ .47	+.034	+ .08	+.057	+ .29
+45 . . . +55	+.044	+ .05	+.057	+ .37	+.043	+ .00	+.065	— .26
+50 . . . +60	+.041	— .04	+.023	+ .11	+.007	+ .05	+.058	+ .01
+55 . . . +65	+.049	+ .30	+.018	+ .15	—.018	+ .19	+.060	+ .24
+60 . . . +70	+.078	+ .28	+.048	+ .39	—.006	+ .35	+.045	+ .38
+65 . . . +75	+.098	+ .25	+.056	+ .36	+.015	+ .53	+.059	+ .35
+70 . . . +85	+.065	— .18	+.039	+ .36	+.001	+ .34	+.061	+ .03
+75 . . . +85	+.041	— .22	—.007	+ .36	—.007	+ .04	+.047	— .33

AUWERS *minus* SAFFORD.

δ	$\Delta\alpha$				
	$12^h \ldots 15^h$	$15^h \ldots 18^h$	$18^h \ldots 21^h$	$21^h \ldots 24^h$	$0^h \ldots 2^h$
° °	s.	s.	s.	s.	s.
+ 5 . . . +15	+.018	+.027	+.058	+.036	+.045
+10 . . . +20	+.014	+.027	+.048	+.033	+.053
+15 . . . +25	+.005	+.022	+.042	+.030	+.037
+20 . . . +30	+.004	+.017	+.050	+.043	+.029
+25 . . . +35	+.002	+.013	+.026	+.041	+.045
+30 . . . +40	+.007	—.003	+.012	+.030	+.060
+35 . . . +45	+.014	+.018	+.014	+.056	+.055
+40 . . . +50	+.019	+.049	+.022	+.069	+.068
+45 . . . +55	+.042	+.035	+.072	+.050	+.088
+50 . . . +60	+.004	+.033	+.100	+.043	+.042
+55 . . . +65	+.004	+.045	+.040	+.063	+.026
+60 . . . +70	—.020	+.029	+.013	+.048	+.052
+65 . . . +70	—.013	+.024	+.010	+.080	+.090

In the reduction of a given series of observations from the system of one fundamental catalogue to that of another system, it is obvious that the most independent method of procedure would be to apply to the given series the systematic corrections derived from comparing the system upon which it is based with that to which it is to be reduced. The fact already stated that the Harvard College Catalogue for 1875 depends upon two systems which differ systematically, makes it imperative that the comparison shall be made directly with the system of Auwers. There is also an additional consideration which makes it necessary that this course should be pursued. It

will be seen from the values of $\Delta\alpha$ under Auwers *minus* P' from $+70°$ to $+85°$ that the right ascensions of the Polar stars between 0^h and 6^h are about $.10^s$ too small, while those from 6^h to 18^h are nearly $.10^s$ too great. Hence, in the determination of the instrumental constant n, the values derived from observations made between January and April will be too large, while the values derived from observations made between April and September will be too small. For stars beyond 10° south declination therefore, systematic errors in right ascension will be introduced through n, which will not be corrected by a close adherence to the fundamental system.

In the conversion from one fundamental system to another, two methods have been employed: —

(*a*) *The Analytical Method.*

If we have a series of residuals $\Delta\alpha$, arranged in the order of right ascension, which are strictly circular functions we may always have: —

$$\Delta\alpha = \text{a constant} + m \sin\alpha + n \cos\alpha + m' \sin 2\alpha + n' \cos 2\alpha, \text{ etc.} \tag{1}$$

If $\Delta\alpha$ is a function of the declination we may have approximately the additional equation: —

$$\Delta\alpha = \text{a constant} + a \sin\delta + b \cos\delta. \tag{2}$$

In practice it will ordinarily be sufficient to assume: —

$$\Delta\alpha = \text{a constant} + m \sin\alpha + n \cos\alpha + a \sin\delta + b \cos\delta. \tag{3}$$

In Volume X. of the Annals of the Observatory the values of $\Delta\alpha$ were first computed from equation (1). The computed values having been subtracted from the observed values, a new series of residuals was obtained which were assumed to be functions of the declination. New values of $\Delta\alpha$ were then computed from equations of the form (2). The total correction was then assumed to be the sum of these two computed partial residuals.

For the residuals in declination we may with less exactness assume: —

$$\Delta\delta = \text{a constant} + c \sin\delta + d \cos\delta.$$

(*b*) *The Graphical Method.*

If we assume any given unit in right ascension as a horizontal argument, and an aliquot part of $\Delta\alpha$ as a vertical argument, it is obvious that points representing $\Delta\alpha$ may be laid off which will bear a definite relation to a fixed horizontal line. If a smooth curve is drawn through these points, values of $\Delta\alpha$ nearly representing observation may be derived for any right ascension by reading off the vertical co-ordinate passing through the curve at this point. By a similar method of procedure we may obtain the values of $\Delta\delta$ which represent the observations.

Each of these methods has its strenuous advocates. The objection most frequently urged against the first method is that in an analytical solution, extended to terms of the second order only, there can be only two points of inflexion in a curve representing the computed residuals. If therefore the residuals between two systems are really represented by a curve which has several points of inflexion, the analytical method must be less exact than the method of graphic curves. Again, it often happens that residuals having the same sign and nearly the same magnitude are concentrated at one point. The effect of the analytical solution is to distribute the assumed errors at this point over the whole system in such a way that the sum of the squares of the residuals shall be as small as possible. But if these errors are real, they belong to this point only, and they should *not* be distributed over the whole system.

The objection to the second method is that for a given series of points representing $\Delta\alpha$ or $\Delta\delta$, no two persons would describe exactly the same curve. This objection is to a certain extent obviated by the plan of successive bisections of the lines joining the points, described by Professor Pickering in Vol. X. of the Annals of the Observatory. In drawing a curve by this method, two points require attention. First, that the uncertainty with regard to the ends of the curve will be increased in proportion to the number of bisections, and second, that each successive bisection causes the curve to approach a straight line. In order to draw a regular curve, it will rarely be necessary to make more than three bisections. It is my custom to use the curve drawn through the final bisecting points as a guide in drawing the curve most nearly representing the observations. To this extent, therefore, the final curve is dependent upon the judgment of the computer. The uncertainty thus introduced will rarely exceed $.005^s$ for any residual in α, and will, I think, never exceed $.01^s$. It is obvious that the case in which this uncertainty is the greatest is that in which there is a sudden change in the direction of the curve, followed by a nearly flat curve for three or four points of the horizontal argument, and this in turn followed by a sharp return to the original direction.

As illustrations of the degree of conformity which may be expected from the two methods, I give below in parallel columns the observed residuals, the residuals derived from the equations, and those derived from the graphic curves, for the following authorities: —

	Catalogues compared.		*Equations.*
I.	Auwers *minus* P';	$\Delta\alpha$ from $+70°$ to $+85°$	$\Delta\alpha = +.069^s +.065^s m +.041^s n +.029^s m' +.011^s n'$
II.	Auwers *minus* H. C. O.;	$\Delta\alpha$ from $+70°$ to $+85°$	$\Delta\alpha = +.033 +.007 m +.029 n -.009 m' -.001 n'$
III.	Auwers *minus* Struve;	$\Delta\delta$ from $+70°$ to $+85°$	$\Delta\delta = +.03'' -.08'' m -.20'' n +.03'' m' +.09'' n'$
IV.	Auwers *minus* Safford;	$\Delta\delta$ from $+10°$ to $+70°$	$\Delta\delta = -.09 +.57 c -.48 d$

$\Delta\alpha$

α	I.					II.				
	Observation.	Equation.	Curve.	$O-E$	$O-C$	Observation.	Equation.	Curve.	$O-E$	$O-C$
h. h.	s.	s.	s.	s.	s.	s.	s.	s.	s.	s.
0 ... 2	+.154	+.149	+.135	+.005	+.019	−.008	+.058	+.046	−.066	−.054
2 ... 4	+.187	+.173	+.173	+.014	+.014	+.121	+.050	+.070	+.071	+.051
4 ... 6	+.128	+.149	+.138	−.021	−.010	+.050	+.043	+.064	+.007	−.014
6 ... 8	+.086	+.097	+.117	−.011	−.031	+.019	+.039	+.020	−.020	−.001
8 ... 12	+.119	+.057	+.077	+.062	+.042	−.013	+.026	+.026	−.039	−.039
10 ... 12	−.041	+.041	+.015	−.082	−.056	+.051	+.010	+.016	+.041	+.035
12 ... 14	+.096	+.036	+.001	+.060	+.095	+.001	−.002	+.008	+.003	−.007
14 ... 16	−.007	+.023	+.001	−.030	−.008	−.009	−.002	−.004	−.007	−.005
16 ... 18	+.023	+.000	+.011	+.023	+.012	+.009	+.015	+.010	−.006	−.001
18 ... 20	−.025	−.009	+.025	−.016	−.050	+.035	+.039	+.038	−.004	−.003
20 ... 22	+.035	+.023	+.043	+.012	−.008	+.078	+.058	+.068	+.020	+.010
24 ... 0	+.078	+.086	+.075	−.008	+.003	+.063	+.062	+.060	+.001	+.003

$\Delta\delta$

III.						IV.					
α	Observation.	Equation.	Curve.	$O-E$	$O-C$	δ	Observation.	Equation.	Curve.	$O-E$	$O-C$
h. h.	"	"	"	"	"	° °	"	"	"	"	"
0 ... 2	+.03	−.08	−.07	+.11	+.10	+10 ... +15	−.39	−.46	−.39	+.07	+.00
2 ... 4	−.16	−.14	−.15	−.02	−.01	+10 ... +20	−.37	−.41	−.36	+.04	−.01
4 ... 6	−.31	−.17	−.18	−.14	−.13	+15 ... +25	−.31	−.35	−.31	+.04	+.00
6 ... 8	−.21	−.09	−.11	−.12	−.10	+20 ... +30	−.25	−.29	−.27	+.04	+.02
8 ... 10	+.32	+.08	+.15	+.24	+.17	+25 ... +35	−.28	−.28	−.26	+.00	−.02
10 ... 12	+.14	+.26	+.22	−.12	−.08	+30 ... +40	−.24	−.16	−.23	−.08	−.01
12 ... 14	+.17	+.33	+.24	−.16	−.07	+35 ... +45	−.18	−.10	−.18	−.08	+.00
14 ... 16	+.27	+.26	+.24	+.01	+.03	+40 ... +50	−.11	−.03	−.11	−.08	+.00
16 ... 18	+.18	+.10	+.18	+.08	+.00	+45 ... +55	+.00	+.04	+.00	−.04	+.00
18 ... 20	−.07	−.03	−.01	−.04	−.06	+50 ... +60	+.18	+.11	+.16	+.07	+.02
20 ... 22	−.22	−.08	−.13	−.14	−.09	+55 ... +65	+.25	+.17	+.25	+.08	+.00
22 ... 0	−.16	−.08	−.12	−.08	−.04	+60 ... +70	+.27	+.23	+.26	+.04	+.01
......	...	...	...	...	...	+65 ... +75	+.25	+.29	+.27	−.04	−.02

The residuals under Auwers *minus* P' and Auwers *minus* H. C. O. involve comparatively large accidental errors. Those under Auwers *minus* Struve, and especially those under Auwers *minus* Safford, are nearly free from accidental errors. While there is a close agreement between the values, $O-E$ and $O-C$, in every case, it is obvious that in the first two cases there is little to choose between the two methods, but that in the last two cases, the graphic method yields the best results.

The choice of the method to be used depends, for the most part, upon the magnitude of the accidental errors, but unfortunately it is often impossible to decide whether the errors are real or accidental. The graphic method is by far the most expeditious, and with hardly an exception it may be safely followed.

Both of these methods of comparing different catalogues, are open to the objection that the coördinates of any given star, when referred in this way to a normal system, may differ by a small amount from the values of the coördinates derived by a direct reduction of the instrumental constants from the fundamental stars of the system. I estimate the uncertainty arising in this way to be $.015^s$ in $\Delta\alpha$ and $0.20''$ in $\Delta\delta$. In the reduction of the zone stars observed at the Harvard College Observatory, the instrumental constants from 1871 to 1876 have been recomputed from the positions given in Publication XIV. When, therefore, the final catalogue is completed, the data will be at hand for a definite determination of the amount of this uncertainty. But since this reduction is wholly impracticable in the case of catalogues already published finally, some method of reducing different catalogues to a homogeneous system is a necessity in the determination of proper motions.

Admitting this necessity, that method is to be preferred which will reduce the residuals in $\Delta\alpha$ and $\Delta\delta$ to a minimum, *whatever the order or the limits of the groups into which they may be divided.*

The method pursued in this investigation is the following: —

(*a*) The residuals are first arranged in the order of declination. The mean values for any group represent nearly the corrections for the mean declination of that group and for twelve hours of right ascension.

(*b*) The residuals for each group minus the mean value for that group, are then arranged in the order of right ascension, and a graphic curve is drawn through the points representing these values. Each curve will give a series of values for the even hours of right ascension, which are arranged in vertical columns, the horizontal argument being the mean declination. It will be seen that the values in the vertical columns are derived from the same curve, while those in the horizontal columns are derived from different curves. In order to connect the different groups in declination, a curve is drawn through the points represented by the residuals in the horizontal columns. This will, of course, disturb to a slight extent the values already found in the vertical columns, but they can be rectified in the way already described. A second approximation will ordinarily give smooth curves for both the vertical and the horizontal arguments. In this investigation, however, I have preferred to retain the values derived directly from the original curves without any attempt to smooth them.

(*c*) On account of the limited number of the residuals which usually compose the groups arranged in the order of declination, there is danger of introducing systematic errors in drawing the graphic curves. Hence after the sum of the two residuals already found has been subtracted from the original residuals, the new values are

arranged in the order of right ascension and a curve is drawn through the points thus found.

REDUCTION OF THE HARVARD COLLEGE OBSERVATIONS TO THE SYSTEM OF AUWERS.

It is not considered necessary to give the details of the reductions which form the basis of the tables given below. After the sum of the corrections determined by the method described above from groups between the limits $\delta = -10^\circ$ and $\delta = +80^\circ$ had been applied, it was found that the deviations from the normal system were as follows:—

AUWERS *minus* HARVARD COLLEGE.

Residuals in α.

Limits δ	$\Delta\alpha$	Limits in δ	$\Delta\alpha$	Limits in δ	$\Delta\alpha$	Limits in α	$\Delta\alpha$
° °	s.	° °	s.	° °	s.	h. h.	s.
—30 . . . —25	—.006	—31.5 . . . —27.5	—.010	—30 . . . —25	—.004	0 . . . 2	+.003
—25 . . . —20	—.001	—27.5 . . . —22.5	—.004	—25 . . . —15	+.000	2 . . . 4	+.000
—20 . . . —15	+.007	—22.5 . . . —17.5	+.005	—15 . . . — 5	+.004	4 . . . 6	+.000
—15 . . . —10	—.009	—17.5 . . . —12.5	—.001	— 5 . . . + 5	—.009	6 . . . 8	—.001
—10 . . . — 5	+.012	—12.5 . . . — 7.5	+.009	+ 5 . . . +15	—.003	8 . . . 10	—.005
— 5 . . . — 0	—.002	— 7.5 . . . — 2.5	+.003	+15 . . . +25	—.002	10 . . . 12	+.004
+ 0 . . . + 5	—.016	— 2.5 . . . + 2.5	—.006	+25 . . . +35	+.004	12 . . . 14	+.001
+ 5 . . . +10	+.001	+ 2.5 . . . + 7.5	—.011	+35 . . . +45	+.002	14 . . . 16	+.003
+10 . . . +15	—.007	+ 7.5 . . . +12.5	+.002	+45 . . . +55	+.003	16 . . . 18	—.003
+15 . . . +20	—.002	+12.5 . . . +17.5	—.006	+55 . . . +65	+.004	18 . . . 20	+.002
+20 . . . +25	—.002	+17.5 . . . +22.5	—.001	+65 . . . +75	—.003	20 . . . 22	+.002
+25 . . . +30	+.007	+22.5 . . . +27.5	+.000	+75 . . . +85	—.014	22 . . . 24	+.003
+30 . . . +35	+.003	+27.5 . . . +32.5	+.003	. . . . . .	. . .	. . . .	. . .
+35 . . . +40	+.003	+32.5 . . . +37.5	+.005	. . . . . .	. . .	. . . .	. . .
+40 . . . +45	+.003	+37.5 . . . +42.5	+.003	. . . . . .	. . .	. . . .	. . .
+45 . . . +50	+.005	+42.5 . . . +47.5	+.005	. . . . . .	. . .	. . . .	. . .
+50 . . . +55	—.001	+47.5 . . . +52.5	+.002	. . . . . .	. . .	. . . .	. . .
+55 . . . +60	+.003	+52.5 . . . +57.5	+.001	. . . . . .	. . .	. . . .	. . .
+60 . . . +65	+.006	+57.5 . . . +62.5	—.001	. . . . . .	. . .	. . . .	. . .
+65 . . . +70	—.009	+62.5 . . . +67.5	—.002	. . . . . .	. . .	. . . .	. . .
+70 . . . +75	+.005	+67.5 . . . +72.5	—.006	. . . . . .	. . .	. . . .	. . .
+75 . . . +80	—.014	+72.5 . . . +77.5	—.002	. . . . . .	. . .	. . . .	. . .
+80 . . . +85	—.003	+77.5 . . . +82.5	—.025	. . . . . .	. . .	. . . .	. . .

Residuals in δ.

Limits in α	−30° .. −15°	−15° .. +5°	+5° .. +25°	+25° .. +45°	+45° .. +65°	+65° .. +85°
h. h.	″	″	″	″	″	″
0 . . . 3	+.06	−.34	+.03	+.00	+.14	−.17
3 . . . 6	−.25	+.21	−.10	−.06	−.05	−.16
6 . . . 9	+.23	+.00	+.21	+.03	+.00	−.30
9 . . . 12	+.36	+.18	+.08	−.05	+.09	+.14
12 . . . 15	−.43	−.15	−.19	−.19	+.00	+.02
15 . . . 18	−.12	−.10	−.17	+.03	−.03	+.13
18 . . . 21	+.12	−.22	+.06	+.26	−.03	−.09
21 . . . 24	−.42	−.05	−.12	+.16	−.06	+.09
Means by Weights. }	−.06	−.07	−.02	+.02	+.01	−.04

Limits in α	−30° .. −10°	−10° .. +5°	+5° .. +20°	+20° .. +35°	+35° .. +50°	+50° .. +65°	+65° .. +85°
h. h.	″	″	″	″	″	″	″
0 . . . 4	+.11	+.07	−.03	+.01	+.03	−.01	−.15
4 . . . 8	+.21	+.36	+.14	−.02	−.07	+.04	−.33
8 . . . 12	+.24	+.16	+.02	−.03	−.04	−.01	+.16
12 . . . 16	+.05	+.22	−.13	−.08	−.07	−.11	+.05
16 . . . 20	+.17	−.18	+.01	+.06	−.09	−.09	+.02
20 . . . 24	+.05	−.17	−.13	+.19	+.12	−.07	−.08
Means by Weights. }	+.14	+.06	−.02	+.02	−.02	−.04	−.05

It did not seem necessary to recompute the double argument corrections in α, but for the terms depending on α and δ new curves were drawn from the values of Δα given above, and the secondary corrections obtained were applied to the corresponding values given by the first set of curves.

The residuals in declination, however, appeared to require a complete second approximation. Accordingly, new curves were drawn from the residuals in δ, in the manner described above. The results from the two approximations are combined in the following tables.

Δα. Auwers *minus* Harvard College.

Corrections depending on δ

δ	Δα	δ	Δα	δ	Δα
°	s.	°	s.	°	s.
−30	−.048	+ 2	−.011	+45	+.049
−28	−.041	+ 4	−.009	+50	+.050
−26	−.033	+ 6	−.003	+52	+.047
−24	−.027	+ 8	+.001	+54	+.042
−22	−.021	+10	+.004	+56	+.038
−20	−.017	+12	+.007	+58	+.037
−18	−.013	+14	+.009	+60	+.036
−16	−.010	+16	+.011	+62	+.038
−14	−.007	+18	+.014	+64	+.043
−12	−.006	+20	+.018	+66	+.047
−10	−.005	+22	+.024	+68	+.048
− 5	−.005	+24	+.028	+70	+.048
− 4	−.007	+26	+.032	+72	+.045
− 3	−.010	+28	+.035	+74	+.042
− 2	−.012	+30	+.038	+76	+.036
− 1	−.014	+35	+.041	+78	+.025
+ 0	−.015	+40	+.044	+80	+.013
. . .	. . . .	. . .	. . . .	. . .	. . . .

Corrections depending on α

α	Δα	α	Δα	α	Δα	α	Δα
h.	s.	h.	s.	h.	s.	h.	s.
0.0	−.004	5.0	−.014	12.4	+.006	17.5	+.004
0.2	−.007	5.5	−.022	12.6	+.002	18.0	+.007
0.4	−.010	6.0	−.026	12.8	−.001	18.2	+.009
0.6	−.009	6.2	−.025	13.0	−.005	18.4	+.014
0.8	−.001	6.4	−.021	13.2	−.008	18.6	+.017
1.0	+.013	6.6	−.017	13.6	−.010	18.8	+.019
1.2	+.017	7.0	−.014	14.0	−.011	19.0	+.019
1.6	+.018	7.4	−.011	14.2	−.014	19.4	+.007
2.0	+.015	7.8	−.007	14.4	−.019	19.8	+.014
2.4	+.013	8.0	−.006	14.6	−.022	20.0	+.010
2.8	+.007	8.5	−.002	15.0	−.017	20.5	+.005
3.0	+.005	9.0	+.003	15.2	−.008	21.0	+.007
3.2	+.002	9.5	+.010	15.4	−.004	22.0	+.007
3.4	−.001	10.0	+.018	15.6	−.002	22.5	+.005
3.6	−.003	11.0	+.021	15.8	+.000	23.0	+.003
3.8	−.007	11.5	+.016	16.0	−.001	23.4	−.005
4.0	−.008	12.0	+.012	16.5	−.002	23.8	−.006
4.5	−.010	12.2	+.009	17.0	−.002	0.0	−.004

Δα. Corrections depending on both α and δ.

[In units of the third decimal place.]

h.	−30°	−25°	−20°	−15°	−10°	−5°	+0°	+5°	+10°	+15°	+20°	+25°	+30°	+35°	+40°	+45°	+50°	+55°	+60°	+65°	+70°	+75°	+80°
0	−23	−18	−14	− 9	− 6	−3	−1	+1	+ 2	+4	+5	+ 6	+ 7	+ 7	+ 6	+ 5	+ 5	+ 8	+11	+14	+16	+20	+23
1	−21	−18	−14	−10	− 7	−4	−1	+0	+ 1	+2	+2	+ 2	+ 2	+ 2	+ 2	+ 2	+ 3	+ 8	+12	+16	+19	+22	+25
2	−17	−16	−14	−10	− 7	−4	−1	+0	+ 1	+1	+1	+ 0	− 1	− 2	− 3	− 2	+ 2	+11	+21	+24	+24	+22	+15
3	−11	−14	−14	−12	− 7	−2	+0	+1	+ 2	+1	+0	− 2	− 4	− 5	− 6	− 4	− 1	+ 9	+17	+22	+22	+21	+14
4	− 7	−11	−13	−13	− 9	−4	+0	+4	+ 4	+3	+0	− 2	− 4	− 6	− 6	− 4	− 1	+ 7	+17	+24	+24	+20	+10
5	+ 1	− 7	−13	−14	−10	−3	+1	+4	+ 5	+3	+0	− 4	− 6	− 6	− 6	− 4	− 1	+ 5	+13	+24	+26	+21	+ 7
6	+ 5	− 5	−11	−12	−11	−5	+3	+8	+ 7	+2	−4	− 6	− 7	− 7	− 6	− 3	+ 0	+ 5	+12	+22	+22	+20	+ 6
7	+ 9	− 1	−10	−12	−11	−7	+4	+9	+ 9	+2	−5	− 8	− 9	− 7	− 4	− 1	+ 1	+ 4	+11	+22	+24	+15	− 2
8	+10	+ 0	− 7	−11	−12	−9	+5	+9	+ 8	+3	−5	−10	− 9	− 6	− 1	+ 2	+ 2	+ 2	+ 7	+20	+20	+13	− 3
9	+ 9	+ 0	− 6	− 9	−11	−8	+5	+9	+ 8	+3	−4	− 9	− 9	− 6	+ 1	+ 4	+ 3	+ 0	+ 2	+18	+19	+10	− 4
10	+ 8	+ 4	− 3	− 7	− 8	−6	+5	+9	+ 8	+3	−3	− 8	− 8	− 5	+ 0	+ 2	+ 2	− 1	+ 1	+15	+17	+ 7	− 6
11	+ 5	+ 5	+ 0	− 3	− 5	−4	+4	+6	+ 5	+2	−2	− 6	− 7	− 3	+ 1	+ 1	+ 0	− 5	− 3	+ 6	+ 8	+ 3	− 6
12	+ 5	+ 4	+ 1	+ 0	+ 0	+0	+2	+1	+ 1	+0	−1	− 3	− 5	− 2	− 1	− 1	− 3	− 6	− 7	− 2	− 1	− 4	−10
13	+ 7	+ 6	+ 5	+ 4	+ 3	+1	+0	−2	− 3	−4	−4	− 3	− 3	− 2	− 2	− 3	− 6	−11	−13	−13	−14	−14	−14
14	+10	+ 9	+ 9	+ 8	+ 6	+3	+0	−5	− 8	−6	+0	+ 2	+ 1	+ 0	− 2	− 4	− 8	−15	−18	−19	−20	−21	−21
15	+ 8	+10	+11	+11	+ 8	+4	+0	−7	−11	−7	+1	+ 2	+ 2	+ 0	− 2	− 5	− 9	−15	−19	−21	−22	−22	−22
16	+ 9	+11	+12	+11	+10	+6	−2	−8	−11	−7	+3	+ 6	+ 4	+ 2	− 1	− 5	− 8	−11	−16	−21	−25	−26	−20
17	+ 7	+10	+12	+12	+10	+6	−4	−9	−10	−5	+5	+ 6	+ 5	+ 3	+ 0	− 2	− 5	−11	−19	−23	−25	−21	−10
18	+ 3	+ 8	+11	+12	+10	+5	−4	−9	− 8	−2	+5	+ 6	+ 6	+ 6	+ 5	+ 3	+ 1	− 2	− 8	−18	−21	−15	− 5
19	+ 1	+ 6	+ 9	+11	+10	+7	−3	−6	− 4	+1	+5	+ 7	+ 8	+ 8	+ 8	+ 9	+ 8	+ 8	+ 3	− 9	−14	− 5	+ 5
20	+ 2	+ 5	+ 7	+ 8	+ 8	+5	−3	−5	− 2	+2	+5	+ 8	+ 9	+10	+10	+10	+11	+13	+ 7	− 7	−12	− 2	+13
21	− 2	+ 0	+ 3	+ 7	+ 8	+6	−4	−4	− 1	+3	+7	+ 9	+11	+11	+11	+11	+13	+18	+14	+ 2	− 4	+ 6	+18
22	− 3	− 3	− 2	+ 1	+ 5	+4	−3	−4	− 1	+5	+7	+ 9	+11	+12	+12	+14	+15	+15	+13	+ 5	+ 7	+11	+20
23	−12	−11	− 9	− 3	+ 0	+1	−2	−3	− 1	+5	+6	+ 8	+ 8	+ 9	+ 8	+ 8	+ 9	+13	+12	+10	+11	+15	+22

Δδ. Auwers *minus* Harvard College.

Corrections depending on δ.

δ	Δδ	δ	Δδ	δ	Δδ	δ	Δδ	δ	Δδ	δ	Δδ	δ	Δδ	δ	Δδ
°	″	°	″	°	″	°	″	°	″	°	″	°	″	°	″
−30	−1.03	−15	+.16	+ 0	+.17	+15	+.34	+30	+.13	+45	+.21	+60	+.23	+75	+.19
−29	− .97	−14	+.26	+ 1	+.07	+16	+.36	+31	+.12	+46	+.19	+61	+.27	+76	+.14
−28	− .89	−13	+.34	+ 2	+.01	+17	+.37	+32	+.12	+47	+.14	+62	+.29	+77	+.06
−27	− .81	−12	+.41	+ 3	−.02	+18	+.37	+33	+.13	+48	+.08	+63	+.32	+78	+.00
−26	− .68	−11	+.48	+ 4	−.04	+19	+.37	+34	+.13	+49	+.01	+64	+.33	+79	−.06
−25	− .62	−10	+.52	+ 5	−.05	+20	+.37	+35	+.14	+50	−.03	+65	+.34	+80	−.18
−24	− .54	− 9	+.53	+ 6	−.05	+21	+.36	+36	+.16	+51	−.06	+66	+.35	+81	−.23
−23	− .47	− 8	+.53	+ 7	−.05	+22	+.34	+37	+.17	+52	−.08	+67	+.35	+82	−.25
−22	− .40	− 7	+.53	+ 8	−.04	+23	+.30	+38	+.19	+53	−.08	+68	+.35	+83	−.33
−21	− .32	− 6	+.53	+ 9	−.02	+24	+.26	+39	+.20	+54	−.08	+69	+.35	+84	−.38
−20	− .27	− 5	+.51	+10	+.00	+25	+.23	+40	+.21	+55	−.06	+70	+.34	+85	−.41
−19	− .20	− 4	+.44	+11	+.06	+26	+.21	+41	+.22	+56	−.03	+71	+.33	+86	−.42
−18	− .13	− 3	+.41	+12	+.17	+27	+.17	+42	+.22	+57	+.02	+72	+.31	+87	−.43
−17	− .06	− 2	+.35	+13	+.26	+28	+.15	+43	+.22	+58	+.10	+73	+.28	+88	−.43
−16	+ .04	− 1	+.27	+14	+.30	+29	+.13	+44	+.22	+59	+.17	+74	+.24	+90	−.43

$\Delta\delta$. *Corrections depending on* α.

α	$\Delta\delta$	α	$\Delta\delta$	α	$\Delta\delta$	α	$\Delta\delta$
h.	″	h.	″	h.	″	n.	″
0.0	—.18	4.5	—.10	10.0	+.21	21.0	+.09
0.2	—.04	5.0	—.10	11.0	+.23	21.2	+.05
0.4	+.03	6.0	—.11	12.0	+.21	21.4	+.03
0.6	+.05	7.0	—.10	13.0	+.18	21.6	+.00
0.8	+.07	7.5	—.06	14.0	+.14	21.8	—.02
1.0	+.10	8.0	—.03	15.0	+.08	22.0	—.04
1.5	+.13	8.2	—.01	15.5	+.04	22.2	—.06
2.0	+.12	8.4	+.01	16.0	+.02	22.4	—.08
2.2	+.10	8.6	+.03	17.0	+.00	22.6	—.10
2.4	+.07	8.8	+.06	18.0	+.01	22.8	—.12
2.6	+.05	9.0	+.09	18.5	+.04	23.0	—.13
2.8	+.02	9.2	+.12	19.0	+.07	23.2	—.14
3.0	—.01	9.4	+.16	19.5	+.10	23.4	—.15
3.5	—.05	9.6	+.19	20.0	+.11	23.6	—.16
4.0	—.08	9.8	+.20	20.5	+.12	0.0	—.18

$\Delta\delta$. CORRECTIONS DEPENDING ON BOTH α AND δ.

[*In units of the second decimal place.*]

h.	−30°	−25°	−20°	−15°	−10°	−5°	+0°	+5°	+10°	+15°	+20°	+25°	+30°	+35°	+40°	+45°	+50°	+55°	+60°	+65°	+70°	+75°	+80°
0	− 6	− 7	− 8	−10	−14	−21	−26	−25	−22	−17	−13	− 6	− 1	+ 2	+ 5	+ 5	+ 4	+ 3	+1	− 4	− 3	−22	−32
1	+ 4	+ 1	− 2	− 4	− 9	−17	−22	−20	−17	−12	− 7	− 3	+ 1	+ 4	+ 5	+ 6	+ 7	+ 6	+2	− 5	−13	−23	−32
2	− 5	− 4	− 6	− 8	−11	−17	−26	−25	−15	− 7	− 2	+ 1	+ 2	+ 4	+ 5	+ 7	+ 8	+ 8	+6	+ 0	− 9	−21	−32
3	−14	−12	−12	−10	− 9	−10	−17	−16	−10	− 2	+ 1	+ 3	+ 3	+ 3	+ 5	+ 7	+ 8	+ 5	+1	− 8	−19	−29	−36
4	−11	− 9	− 5	− 2	+ 1	+ 1	− 1	− 4	− 2	+ 4	+ 7	+ 6	+ 6	+ 5	+ 6	+ 5	+ 4	+ 1	−4	−11	−19	−27	−31
5	− 5	− 7	− 5	− 1	+ 3	+ 5	+ 3	+ 1	+ 4	+ 9	+11	+10	+ 9	+ 7	+ 6	+ 4	+ 2	− 1	−6	−13	−20	−26	−28
6	+ 8	+ 6	+ 8	+12	+14	+16	+17	+18	+21	+24	+23	+20	+17	+16	+14	+12	+ 8	+ 4	−2	−10	−17	−22	−20
7	+36	+31	+26	+20	+18	+19	+21	+26	+32	+33	+33	+30	+27	+23	+19	+16	+11	+ 5	−4	−12	−18	−21	−17
8	+54	+44	+34	+22	+15	+22	+31	+34	+35	+35	+34	+32	+29	+26	+23	+19	+15	+ 6	−5	−12	−17	−17	−10
9	+66	+56	+42	+22	+16	+28	+35	+37	+38	+38	+37	+32	+29	+24	+21	+19	+16	+10	+3	− 3	− 7	− 5	+ 7
10	+50	+49	+42	+25	+18	+31	+34	+35	+34	+32	+30	+28	+23	+21	+19	+20	+18	+15	+9	+ 4	+ 5	+10	+22
11	+38	+29	+21	+10	+ 7	+23	+28	+27	+23	+17	+12	+ 7	+ 6	+ 6	+ 7	+ 8	+ 9	+ 9	+8	+ 8	+ 8	+11	+25
12	−12	−17	−14	−14	−11	+ 2	+ 6	+ 8	+ 8	− 1	− 4	− 7	− 8	− 6	− 4	− 3	− 1	+ 2	+5	+ 7	+10	+14	+22
13	−41	−42	−30	−23	−18	− 4	+ 0	+ 1	− 4	−15	−19	−20	−21	−20	−19	−15	−10	− 5	+2	+ 7	+11	+15	+18
14	−47	−44	−37	−30	−21	−12	− 3	− 2	−12	−25	−28	−25	−23	−24	−25	−21	−16	− 8	−1	+ 6	+11	+13	+12
15	−51	−48	−40	−31	−25	−19	− 9	− 8	−15	−30	−30	−26	−23	−24	−27	−23	−15	− 9	+0	+ 8	+14	+17	+12
16	−56	−48	−35	−19	−18	−14	−11	−12	−17	−30	−31	−28	−25	−22	−19	−18	−14	−10	−2	+ 6	+15	+19	+14
17	−56	−31	−22	−17	−14	−14	−15	−18	−23	−30	−29	−23	−17	−13	−13	−13	−14	−14	−4	+ 4	+10	+14	+13
18	−37	−26	−18	−12	−11	−15	−18	−21	−22	−24	−21	−13	− 8	− 5	− 4	− 5	− 6	− 6	−1	+ 2	+ 6	+ 7	− 2
19	−23	−19	−14	− 7	− 7	−13	−20	−22	−21	−18	−12	− 7	− 2	+ 1	+ 1	− 3	− 6	− 5	−3	− 2	− 2	− 4	−17
20	−19	−16	−15	−11	−12	−15	−23	−25	−22	−19	−12	− 5	+ 0	+ 2	+ 3	+ 1	− 3	− 4	−3	− 2	− 3	− 7	−20
21	−35	−30	−26	−19	−17	−19	−29	−30	−25	−20	−15	− 6	+ 0	+ 3	+ 4	+ 1	− 4	− 5	−3	− 1	+ 0	− 3	−16
22	−35	−36	−30	−22	−20	−21	−32	−31	−28	−22	−16	− 8	+ 1	+ 2	+10	+ 7	+ 2	− 2	−2	− 4	− 4	− 7	−14
23	−24	−28	−26	−21	−21	−26	−31	−29	−26	−21	−15	− 8	+ 1	+ 5	+14	+ 0	− 3	− 3	−3	− 4	− 5	−10	−16

The following example will illustrate the use of the tables:—

Reduction of the Coördinates of ν Orionis to the System of Auwers.

		h. m. s.		° ′ ″
	$\alpha_0 =$	6 0 26.127	$\delta_0 =$	+14 46 52.05
Corrections.	1	+.010		+.33
	2	—.026		—.11
	3	+.002		+.24
	$\alpha =$	6 0 26.113	$\delta =$	+14 46 52.51

In the formation of the catalogue which follows, the corrections were for convenience taken from the tables derived from the separate approximations. On account of the slight uncertainty in the interpolations from the double argument tables, an occasional deviation of four or five units from the results given by the final table of corrections given above may be found.

AUWERS *minus* SAFFORD.

$\Delta\alpha$. *Corrections depending on* δ.

δ	$\Delta\alpha$	δ	$\Delta\alpha$	δ	$\Delta\alpha$
°	s.	°	s.	°	s.
+10	+.038	+35	+.024	+43	+.038
+12	+.036	+36	+.024	+44	+.041
+14	+.034	+37	+.025	+45	+.043
+16	+.031	+38	+.026	+50	+.045
+18	+.030	+39	+.027	+55	+.039
+20	+.029	+40	+.028	+60	+.034
+25	+.026	+41	+.031	+65	+.035
+30	+.024	+42	+.038	+70	+.042

$\Delta\delta$. *Corrections depending on* δ.

δ	$\Delta\delta$	δ	$\Delta\delta$	δ	$\Delta\delta$	δ	$\Delta\delta$
°	″	°	″	°	″	°	″
+10	—0.39	+25	—0.27	+40	—0.18	+55	+0.16
+11	—0.38	+26	—0.27	+41	—0.18	+56	+0.19
+12	—0.38	+27	—0.26	+42	—0.16	+57	+0.21
+13	—0.37	+28	—0.26	+43	—0.15	+58	+0.22
+14	—0.37	+29	—0.26	+44	—0.13	+59	+0.24
+15	—0.36	+30	—0.26	+45	—0.11	+60	+0.25
+16	—0.35	+31	—0.26	+46	—0.09	+61	+0.26
+17	—0.34	+32	—0.25	+47	—0.07	+62	+0.26
+18	—0.33	+33	—0.25	+48	—0.05	+63	+0.26
+19	—0.32	+34	—0.24	+49	—0.05	+64	+0.26
+20	—0.31	+35	—0.23	+50	—0.03	+65	+0.26
+21	—0.30	+36	—0.22	+51	+0.00	+66	+0.27
+22	—0.29	+37	—0.21	+52	+0.03	+67	+0.27
+23	—0.28	+38	—0.20	+53	+0.05	+68	+0.27
+24	—0.27	+39	—0.19	+54	+0.09	+70	+0.27

AUWERS *minus* SAFFORD.

Δδ. *Corrections depending on both* α *and* δ.

[*In units of the third decimal place.*]

α	10°	15°	20°	25°	30°	35°	40°	45°	50°	55°	60°	65°	70°
h. 12	−25	−26	−27	−29	−27	−19	−19	−20	−22	−25	−28	−33	−39
13	−23	−21	−22	−25	−24	−17	−16	−18	−20	−23	−25	−30	−37
14	−19	−17	−18	−22	−21	−14	−13	−14	−16	−18	−20	−24	−30
15	−15	−14	−14	−17	−17	−13	−11	−11	−12	−13	−14	−16	−19
16	−10	−10	−11	−12	−13	−10	− 8	− 8	− 8	− 8	− 9	−10	−12
17	− 3	− 3	− 5	− 8	− 9	− 8	− 7	− 5	− 3	− 3	− 3	− 3	− 3
18	+ 5	+ 2	+ 1	− 2	− 4	− 6	− 7	− 5	+ 0	+ 2	+ 3	+ 3	+ 2
19	+10	+ 9	+ 5	+ 3	+ 1	− 3	− 5	− 2	+ 5	+12	+13	+11	+ 7
20	+ 9	+11	+11	+10	+ 5	+ 0	+ 0	+ 1	+ 8	+16	+19	+15	+10
21	+ 6	+ 8	+ 9	+11	+ 8	+ 4	+ 3	+ 4	+11	+16	+18	+15	+11
22	+ 2	+ 5	+ 7	+ 9	+11	+10	+10	+11	+12	+15	+16	+15	+16
23	+ 2	+ 4	+ 7	+10	+13	+16	+18	+17	+16	+16	+15	+16	+17
0	+ 5	+ 7	+ 9	+12	+17	+21	+25	+23	+19	+12	+10	+14	+18
1	+ 9	+10	+10	+13	+19	+26	+29	+26	+17	+ 9	+ 9	+15	+17
2	+13	+14	+15	+16	+21	+29	+30	+30	+20	+ 7	+ 8	+16	+20

NOTE. — The residuals in α depending on α alone are so small that I have not considered it worth while to introduce them.

AUWERS *minus* BOSS.

Δδ *Corrections depending on* δ.

δ	Δδ	δ	Δδ	δ	Δδ	δ	Δδ
°	″	°	″	°	″	°	″
−30	−0.79	+ 0	−0.20	+30	−0.04	+60	+0.05
−28	− .75	+ 2	− .18	+32	− .04	+62	+ .06
−26	− .71	+ 4	− .18	+34	− .04	+64	+ .07
−24	− .67	+ 6	− .18	+36	− .05	+66	+ .08
−22	− .64	+ 8	− .18	+38	− .05	+68	+ .09
−20	− .60	+10	− .19	+40	− .06	+70	+ .10
−18	− .56	+12	− .19	+42	− .06	+72	+ .10
−16	− .51	+14	− .19	+44	− .05	+74	+ .11
−14	− .46	+16	− .17	+46	− .05	+76	+ .11
−12	− .41	+18	− .15	+48	− .04	+78	+ .12
−10	− .36	+20	− .11	+50	− .02	+80	+ .12
− 8	− .32	+22	− .07	+52	+ .00	+82	+ .12
− 6	− .27	+24	− .05	+54	+ .01	+84	+ .13
− 4	− .24	+26	− .04	+56	+ .03	+86	+ .13
− 2	− .22	+28	− .04	+58	+ .05	+88	+ .13

AUWERS *minus* NEWCOMB.

$\Delta\alpha$ *Corrections depending on* δ.						$\Delta\delta$ *Corrections depending on* δ.							
δ	$\Delta\alpha$	δ	$\Delta\alpha$	δ	$\Delta\alpha$	δ	$\Delta\delta$	δ	$\Delta\delta$	δ	$\Delta\delta$	δ	$\Delta\delta$
°	s.	°	s.	°	s.	°	″	°	″	°	″	°	″
−30	−.010	− 8	−.002	+35	−.007	−30	−0.73	− 4	−0.22	+22	−0.12	+48	+0.05
−28	−.009	− 6	−.001	+40	−.007	−28	− .72	− 2	− .17	+24	− .10	+50	+ .07
−26	−.008	− 4	−.005	+45	−.006	−26	− .70	+ 0	− .13	+26	− .08	+55	+ .08
−24	−.006	− 2	−.007	+50	−.006	−24	− .68	+ 2	− .12	+28	− .06	+60	+ .09
−22	−.004	+ 0	−.008	+55	−.005	−22	− .66	+ 4	− .12	+30	− .04	+65	+ .09
−20	−.002	+ 5	−.007	+56	−.004	−20	− .64	+ 6	− .13	+32	− .03	+70	+ .10
−18	+.000	+10	−.005	+57	−.002	−18	− .60	+ 8	− .15	+34	− .02	+75	+ .10
−16	+.001	+15	−.004	+58	+.000	−16	− .57	+10	− .18	+36	+ .00	+80	+ .10
−14	+.001	+20	−.003	+59	+.001	−14	− .51	+12	− .18	+38	+ .01	+85	+ .10
−12	+.000	+25	−.003	+60	+.002	−12	− .45	+14	− .18	+40	+ .02	+90	+ .10
−10	−.001	+30	−.005	+61	+.003	−10	− .40	+16	− .18	+42	+ .03	. .	. . .
. .	. . .	. .	. . .	. .	. . .	− 8	− .34	+18	− .17	+44	+ .04	. .	. . .
. .	. . .	. .	. . .	. .	. . .	− 6	− .27	+20	− .14	+46	+ .04	. .	. . .

CATALOGUE OF 334 PRIMARY STARS

OBSERVED DURING THE YEARS 1871, 1872, 1874, AND 1875,

WITH THE

MERIDIAN CIRCLE OF HARVARD COLLEGE OBSERVATORY,

AND REDUCED TO THE FUNDAMENTAL SYSTEM OF AUWERS,

FOR THE EPOCH 1875.0.

NAME OF STAR.	Right Ascensions for 1875.0.	Auwers *minus* H. C. O.	*Safford *minus* H. C. O	*Newcomb *minus* H. C. O.	Declinations for 1875.0.	Auwers *minus* H. C. O.	*Safford *minus* H. C. O.	*Boss *minus* H. C. O.	*Newcomb *minus* H. C. O.
	h. m. s.	s.	s.	s.	° ′ ″	″	″	″	″
α Andromedæ .	0 1 55.762	–.002	–.012	–.002	+28 24 0.87	–0.08	–0.03	–0.16	–0.14
22 Andromedæ .	0 3 49.774	+.014	+.082	. . .	+45 22 34.92	+0.23	+0.38	. . .	. . .
γ Pegasi . . .	0 6 48.032	+.007	+.017	+.006	+14 29 18.26	+0.29	+0.07	+0.22	+0.23
Groom. 29 . .	0 9 10.378	–.170	. . .	. . .	+76 15 21.68	–0.25	. . .	. . .	. . .
ι Ceti	0 13 3.534	–.003	. . .	. . .	– 9 31 1.76	–0.16	. . .	. . .	. . .
12 Ceti	0 23 39.591	+.000	. . .	–.023	– 4 38 53.81	–0.11	. . .	. . .	–0.04
κ Cassiopeiæ . .	0 25 54.558	–.008	+.009	. . .	+62 14 29.33	+0.21	+0.33	+0.41	. . .
α Cassiopeiæ . .	0 33 25.459	–.003	+.049	+.039	+55 51 5.34	–0.17	+0.05	–0.20	–0.15
21 Cassiopeiæ . .	0 37 25.845	–.063	. . .	. . .	+74 18 15.37	+0.22	. . .	+0.42	+0.40
ζ Andromedæ .	0 40 42.946	–.008	+.023	. . .	+23 35 12.13	+0.15	+0.30	+0.50	. . .
η Cassiopeiæ . .	0 41 32.938	–.090	–.061	. . .	+57 9 8.22	+0.02	–0.31	+0.05	. . .
γ Cassiopeiæ . .	0 49 10.699	–.019	+.004	. . .	+60 2 21.12	+0.26	+0.43	+0.43	. . .
ε Piscium . . .	0 56 27.429	–.006	. . .	–.023	+ 7 13 0.10	–0.12	. . .	–0.35	–0.31
44 H. Cephei . .	1 1 32.954	+.008	. . .	. . .	+79 0 27.64	–0.56	. . .	. . .	. . .
β Andromedæ .	1 2 44.300	+.001	+.040	–.016	+34 57 25.95	+0.17	+0.32	+0.10	+0.14
τ Piscium . . .	1 4 46.792	+.019	–.010	. . .	+29 25 31.93	–0.40	+0.51	. . .	. . .
α Ursæ Minoris .	1 12 59.929	+.112	. . .	. . .	+88 38 33.55	+0.30	. . .	+0.45	+0.41
ψ Cassiopeiæ . .	1 17 7.625	+.035	–.001	. . .	+67 28 35.18	+0.50	+0.69	. . .	. . .
θ Ceti	1 17 46.554	+.008	. . .	–.020	– 8 49 44.83	–0.03	. . .	+0.16	+0.13
η Piscium . . .	1 24 47.791	+.008	–.006	+.006	+14 42 2.39	–0.18	+0.05	+0.07	+0.07
υ Persei . . .	1 30 19.726	–.010	–.052	. . .	+47 59 38.07	+0.40	+0.27	+0.36	. . .
43 Cassiopeiæ . .	1 33 6.560	–.032	–.133	. . .	+67 24 35.17	–0.69	–0.30	. . .	. . .
ν Piscium . . .	1 34 55.654	–.006	. . .	–.011	+ 4 51 15.98	–0.63	. . .	. . .	–0.59
ο Piscium . . .	1 38 47.646	+.014	. . .	+.022	+ 8 31 39.49	+0.43	. . .	+0.14	+0.17
β Arietis . . .	1 47 44.268	–.011	+.004	–.016	+20 11 45.72	+0.00	+0.27	+0.11	+0.07
50 Cassiopeiæ . .	1 52 47.974	+.015	. . .	. . .	+71 48 53.93	–0.34	. . .	+0.01	+0.01
γ Andromedæ .	1 56 13.980	+.013	–.038	. . .	+41 43 43.16	+0.33	+0.17	+0.28	. . .
α Arietis . . .	2 0 7.796	+.005	. . .	+.004	+22 52 13.38	–0.28	. . .	–0.28	–0.32
β Trianguli . .	2 2 6.625	+.028	. . .	. . .	+34 23 41.42	+0.08	. . .	+0.27	. . .
55 Cassiopeiæ . .	2 4 41.802	+.052	. . .	. . .	+65 56 11.37	+1.44	. . .	. . .	. . .

* After reduction to the system of Auwers.

NAME OF STAR.	Right Ascensions for 1875.0.	Auwers *minus* H. C. O.	Safford *minus* H. C. O.	Newcomb *minus* H. C. O.	Declinations for 1875.0.	Auwers *minus* H. C. O.	Safford *minus* H. C. O.	Boss *minus* H. C. O.	Newcomb *minus* H. C. O.
	h. m. s.	s.	s.	s	° ′ ″	″	″	″	″
6 Persei . . .	2 5 18.120	–.015	. . .	. . .	+50 29 1.74	–0.20	. . .	. . .	. . .
γ Trianguli . .	2 9 53.284	–.001	. . .	. . .	+33 16 4.01	+0.21	. . .	. . .	. . .
67 Ceti	2 10 44.996	–.025	. . .	. . .	– 6 59 58.57	+1.67	. . .	. . .	. . .
o Ceti	2 13 1.947	+.005	. . .	. . .	– 3 32 47.37	+0.02	. . .	. . .	. . .
ι Cassiopeiæ . .	2 18 47.572	+.056	. . .	. . .	+66 50 19.69	–0.44	. . .	–0.34	–0.33
ξ² Ceti	2 21 30.876	+.006	. . .	+.012	+ 7 53 54.68	+0.31	. . .	+.017	+0.18
36 H. Cassiopeiæ .	2 26 11.439	–.006	. . .	. . .	+72 16 9.62	+0.26	. . .	+.004	. . .
ν Arietis . . .	2 31 43.302	–.025	. . .	–.043	+21 25 10.63	+0.00	. . .	. . .	+0.45
δ Ceti	2 33 4.570	+.032	. . .	. . .	– 0 12 43.50	+0.14	. . .	. . .	. . .
Groom. 537 .	2 34 5.943	+.025	. . .	. . .	+67 17 29.23	+0.25	. . .	. . .	. . .
θ Persei . . .	2 35 40.260	+.024	. . .	. . .	+48 41 53.41	–0.21	. . .	–0.21	. . .
γ Ceti	2 36 49.516	–.019	. . .	–.036	+ 2 42 28.27	–0.45	. . .	–0.29	–0.23
41 Arietis . . .	2 42 37.765	+.009	. . .	. . .	+26 44 37.86	–0.06	. . .	–0.11	. . .
τ Persei . . .	2 45 24.357	–.008	. . .	. . .	+52 14 56.68	+0.21	. . .	+0.23	. . .
47 H. Cephei . .	2 49 33.603	+.123	. . .	. . .	+78 55 17.49	–0.17	. . .	–0.78	. . .
α Ceti	2 55 44.791	–.011	. . .	–.004	+ 3 35 53.44	–0.72	. . .	–0.73	–0.68
ϱ Persei . . .	2 57 10.307	–.011	. . .	. . .	+38 21 15.61	–0.40	. . .	–0.27	. . .
β Persei . . .	3 0 2.488	–.001	. . .	. . .	+40 28 20.36	–0.07	. . .	+0.06	. . .
δ Arietis . . .	3 4 29.030	–.012	. . .	–.017	+19 15 8.32	+0.09	. . .	. . .	+0.34
48 H. Cephei . .	3 4 32.137	–.013	. . .	. . .	+77 16 18.84	+0.44	. . .	+0.47	+0.45
α Persei . . .	3 15 24.432	+.000	. . .	+.010	+49 24 51.19	+0.23	. . .	+0.21	+0.31
o Tauri. . . .	3 18 5.288	+.002	. . .	. . .	+ 8 35 14.80	–0.17	. . .	–0.30	. . .
ξ Tauri. . . .	3 20 23.748	+.040	. . .	. . .	+ 9 17 42.99	–0.22	. . .	–0.01	. . .
f Tauri. . . .	3 23 58.403	+.013	. . .	–.004	+12 30 23.98	+0.02	. . .	. . .	+0.29
ε Eridani . . .	3 27 2.513	–.001	. . .	–.003	– 9 52 58.62	+0.13	. . .	. . .	–0.01
Groom. 716. .	3 31 19.525	+.031	. . .	. . .	+62 48 33.52	–1.30	. . .	. . .	. . .
δ Persei . . .	3 34 1.924	+.003	. . .	+.014	+47 23 8.41	+0.13	. . .	+0.04	+0.14
5 H. Camelopardi	3 37 11.738	–.020	. . .	. . .	+70 56 38.14	–0.08	. . .	. . .	. . .
η Tauri. . . .	3 40 3.388	+.005	. . .	–.016	+23 43 0.54	+0.03	. . .	–0.03	–0.08
ζ Persei . . .	3 46 16.690	–.008	. . .	–.021	+31 30 37.99	–0.34	. . .	–0.47	–0.46
9 H. Camelopardi	3 46 29.575	–.021	. . .	. . .	+60 44 23.26	+1.17	. . .	. . .	. . .
ε Persei . . .	3 49 28.212	–.008	. . .	. . .	+39 38 47.52	+0.01	. . .	. . .	. . .
λ Tauri. . . .	3 53 45.394	–.004	. . .	+.016	+12 8 7.21	–0.06	. . .	. . .	–0.04
Groom. 750 .	3 57 58.197	+.218	. . .	. . .	+85 13 19.82	+0.21	. . .	+0.58	. . .
c Persei . . .	3 59 35.605	–.049	. . .	. . .	+47 22 35.21	–0.20	. . .	–0.58	. . .
o¹ Eridani . . .	4 5 45.850	+.047	. . .	. . .	– 7 9 54.39	+0.00	. . .	. . .	. . .
γ Tauri. . . .	4 12 40.887	–.008	. . .	–.005	+15 19 25.67	+0.03	. . .	+0.38	+0.38
δ Tauri. . . .	4 15 43.668	–.014	. . .	+.001	+17 14 50.74	–0.08	. . .	. . .	+0.03
ε Tauri. . . .	4 21 19.156	–.007	. . .	–.020	+18 54 4.34	–0.21	. . .	–0.06	–0.06
1 Camelop. seq. .	4 22 8.196	–.010	. . .	. . .	+53 38 12.03	–0.59	. . .	. . .	. . .
α Tauri. . . .	4 28 44.937	+.011	. . .	+.022	+16 15 21.16	+0.36	. . .	+0.45	+0.45
ν Eridani . . .	4 30 4.439	–.020	. . .	. . .	– 3 36 34.76	–0.38	. . .	. . .	. . .
Groom. 848. .	4 32 2.968	–.003	. . .	. . .	+75 42 31.35	+1.43	. . .	. . .	. . .
τ Tauri. . . .	4 34 44.672	–.037	. . .	–.036	+22 42 54.37	–0.05	. . .	. . .	–0.23
4 Camelopardi .	4 37 35.836	+.000	. . .	. . .	+56 31 55.38	+0.65	. . .	+0.78	. . .

NAME OF STAR.	Right Ascensions for 1875.0.	Auwers *minus* H. C. O.	Safford *minus* H. C. O.	Newcomb *minus* H. C. O.	Declinations for 1875.0.	Auwers *minus* H. C. O.	Safford *minus* H. C. O.	Boss *minus* H. C. O.	Newcomb *minus* H. C. O.
	h. m. s.	s.	s.	s.	° ′ ″	″	″	″	″
μ Eridani . . .	4 39 15.155	+.004	. . .	. . .	− 3 29 7.84	−0.21	. . .	. . .	. . .
9 Camelopardi .	4 41 38.189	−.032	. . .	. . .	+66 7 37.48	−0.59	. . .	−0.67	−0.66
ι Aurigæ . . .	4 48 51.321	+.007	. . .	−.007	+32 57 57.15	−0.05	. . .	+0.09	+0.12
10 Camelopardi .	4 52 18.318	+.059	. . .	. . .	+60 15 22.23	+0.56	. . .	+0.72	. . .
ε Aurigæ . . .	4 53 0.127	−.018	. . .	. . .	+43 38 9.28	−0.21	. . .	−0.34	. . .
ζ Aurigæ . . .	4 53 44.605	−.009	. . .	. . .	+40 53 26.92	+0.43	. . .	+0.33	. . .
ι Tauri	4 55 37.512	+.001	. . .	+.001	+21 24 33.73	−0.35	. . .	. . .	−0.53
19 H. Camelop. .	5 1 59.791	−.079	. . .	. . .	+79 4 54.16	+0.00	. . .	. . .	. . .
λ Eridani . . .	5 3 9.881	+.013	. . .	. . .	− 8 54 58.51	+0.89	. . .	. . .	. . .
μ Aurigæ . . .	5 4 52.570	+.015	. . .	. . .	+38 20 2.25	−0.19	. . .	. . .	. . .
α Aurigæ . . .	5 7 27.430	+.003	. . .	+.000	+45 52 5.67	−0.29	. . .	−0.16	−0.06
β Orionis . . .	5 8 31.846	+.010	. . .	+.014	− 8 20 52.42	+0.06	. . .	+0.13	+0.11
τ Orionis . . .	5 11 32.250	−.029	. . .	. . .	− 6 58 52.50	−0.37	. . .	. . .	. . .
β Tauri	5 18 23.464	−.004	. . .	−.003	+28 29 58.60	−0.13	. . .	−0.15	−0.17
Groom. 966 .	5 23 1.184	+.129	. . .	. . .	+74 57 22.15	+0.22	. . .	+0.37	+0.35
δ Orionis . . .	5 25 37.218	+.027	. . .	+.037	− 0 23 37.07	+0.06	. . .	+0.16	+0.22
ε Orionis . . .	5 29 52.267	−.022	. . .	−.013	− 1 17 1.90	+0.86	. . .	+0.75	+0.81
σ Orionis . . .	5 32 28.279	−.018	. . .	. . .	− 2 40 27.33	+0.42	. . .	. . .	. . .
ο Aurigæ . . .	5 36 13.075	+.003	. . .	. . .	+49 46 7.42	−0.03	. . .	. . .	. . .
ν Aurigæ . . .	5 42 49.627	−.025	. . .	. . .	+39 6 33.19	+0.02	. . .	+0.29	. . .
α Orionis . . .	5 48 24.269	+.004	. . .	+.007	+ 7 22 54.71	−0.41	. . .	−0.55	−0.50
β Aurigæ . . .	5 50 21.619	−.007	. . .	. . .	+44 55 55.22	+0.19	. . .	+0.35	. . .
θ Aurigæ . . .	5 51 11.877	+.010	. . .	. . .	+37 12 5.08	−0.03	. . .	−0.21	. . .
36 Camelopardi .	6 0 16.531	−.100	. . .	. . .	+65 44 22.06	+0.03	. . .	. . .	. . .
ν Orionis . . .	6 0 26.113	−.004	. . .	+.018	+14 46 52.51	+0.22	. . .	. . .	+0.05
22 H. Camelop. .	6 5 4.225	−.089	. . .	. . .	+69 21 35.80	−0.35	. . .	−0.63	−0.62
η Geminorum. .	6 7 19.939	+.004	. . .	+.015	+22 32 27.46	−0.33	. . .	−0.35	−0.38
23 H.Camelop. .	6 24 51.798	+.025	. . .	. . .	+79 41 37.27	−0.75	. . .	. . .	. . .
γ Geminorum .	6 30 29.448	−.013	. . .	−.022	+16 30 13.31	+0.55	. . .	+0.63	+0.61
51 H. Cephei . .	6 41 14.952	+.407	. . .	. . .	+87 14 5.08	−0.45	. . .	−0.63	−0.59
θ Geminorum .	6 44 32.957	+.005	. . .	. . .	+34 6 34.30	+0.48	. . .	+0.14	. . .
15 Lyncis . . .	6 46 26.850	+.008	. . .	. . .	+58 35 0.55	+0.12	. . .	. . .	. . .
ζ Geminorum .	6 56 41.675	−.010	. . .	+.003	+20 45 5.76	+0.04	. . .	−0.11	−0.19
63 Aurigæ . . .	7 3 3.299	+.017	. . .	. . .	+39 31 19.29	+0.25	. . .	. . .	. . .
64 Aurigæ . . .	7 9 20.549	+.004	. . .	. . .	+41 6 10.31	+0.09	. . .	. . .	. . .
λ Geminorum .	7 10 54.503	+.007	. . .	+.026	+16 45 50.06	+0.08	. . .	−0.10	−0.26
δ Geminorum. .	7 12 39.406	−.027	. . .	−.016	+22 12 37.26	+0.44	. . .	+0.27	+0.22
Groom. 1308 .	7 17 51.285	+.046	. . .	. . .	+68 43 3.14	−0.35	. . .	+0.05	+0.06
ι Geminorum .	7 17 57.687	−.007	. . .	−.011	+28 2 40.00	−0.20	. . .	−0.08	−0.25
β Canis Minoris .	7 20 22.269	+.013	. . .	. . .	+ 8 32 21.40	+0.44	. . .	+0.09	. . .
ρ Geminorum .	7 21 4.164	−.009	. . .	+.019	+32 1 51.39	−0.12	. . .	. . .	. . .
α^1 Geminorum .	7 26 36.904	+.200	. . .	. . .	+32 9 36.11	. . .	. . .	. . .	. . .
α^2 Geminorum .	7 26 37.317	−.213	. . .	+.019	+32 9 37.14	+0.17	. . .	+0.72	−0.73
α Canis Minoris .	7 32 45.392	+.010	. . .	−.001	+ 5 32 37.68	−0.37	. . .	. . .	−0.62
β Geminorum .	7 37 39.886	+.003	. . .	+.004	+28 19 34.21	−0.01	. . .	−0.05	−0.07

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	h. m. s.	s.	s.	s.	° ′ ″	″	″	″	″
Groom. 1374 .	7 45 11.562	–.047	. . .	. . .	+74 14 52.12	+0.52	. . .	. . .	. . .
Groom. 1408 .	8 3 46.938	–.012	. . .	. . .	+76 8 4.22	+0.63	. . .	. . .	. . .
β Cancri . . .	8 9 44.097	+.016	. . .	. . .	+ 9 34 8.75	+0.13	. . .	+0.14	. . .
o Ursæ Majoris .	8 19 51.834	–.044	. . .	. . .	+61 8 1.39	–0.20	. . .	–0.53	. . .
η Cancri . . .	8 25 28.689	+.010	. . .	+.014	+20 51 51.05	+0.11	. . .	. . .	–0.07
Groom. 1446 .	8 25 45.577	–.007	. . .	. . .	+74 3 49.13	–0.88	. . .	. . .	. . .
δ Cancri . . .	8 37 34.777	–.014	. . .	–.023	+18 36 43.56	+0.57	. . .	+0.47	+0.33
ε Hydræ . . .	8 40 9.326	–.006	. . .	+.002	+ 6 52 33.75	–0.28	. . .	+0.66	–0.30
57 Cancri. med. .	8 46 36.867	+.004	. . .	. . .	+31 3 4.97	–0.71	. . .	. . .	. . .
ζ Hydræ . . .	8 48 47.088	+.025	. . .	. . .	+ 6 25 12.21	–0.50	. . .	. . .	. . .
ι Ursæ Majoris .	8 50 38.493	–.017	. . .	–.077	+48 31 50.65	+0.25	. . .	+0.19	+0.29
κ Ursæ Majoris .	8 55 4.972	+.042	. . .	. . .	+47 38 56.81	+0.15	. . .	+0.20	. . .
σ^2 Ursæ Majoris .	8 59 22.072	–.016	. . .	. . .	+67 38 23.34	–0.08	. . .	+0.08	+0.08
θ Hydræ . . .	9 7 51.593	+.009	. . .	. . .	+ 2 50 25.60	–0.20	. . .	. . .	. . .
38 Lyncis . . .	9 11 3.646	–.011	. . .	. . .	+37 19 48.21	+0.08	. . .	. . .	. . .
83 Cancri . . .	9 12 0.164	+.010	. . .	+.002	+18 14 1.96	+0.34	. . .	. . .	–0.01
40 Lyncis . . .	9 13 26.138	–.021	. . .	. . .	+34 55 10.57	+0.27	. . .	+0.41	. . .
1 H. Draconis .	9 19 5.932	–.192	. . .	. . .	+81 52 33.02	–0.13	. . .	–0.07	–0.09
α Hydræ . . .	9 21 26.670	+.018	. . .	+.015	– 8 7 4.43	–0.02	. . .	–0.20	–0.21
d Ursæ Majoris .	9 23 23.723	–.018	. . .	. . .	+70 22 40.32	+0.29	. . .	+0.03	+0.03
Groom. 1564 .	9 31 30.803	+.023	. . .	. . .	+69 48 17.46	–0.65	. . .	. . .	. . .
o Leonis . . .	9 34 28.678	+.007	. . .	–.014	+10 27 35.72	–0.17	. . .	+0.00	–0.25
ε Leonis . . .	9 38 45.196	–.005	. . .	–.012	+24 20 55.12	+0.26	. . .	+0.24	+0.19
υ Ursæ Majoris .	9 42 5.127	+.003	. . .	. . .	+59 37 31.55	+0.04	. . .	–0.33	. . .
μ Leonis . . .	9 45 39.081	+.007	. . .	+.004	+26 35 40.89	–0.44	. . .	–0.32	–0.35
Groom. 1586 .	9 47 9.765	–.050	. . .	. . .	+73 28 20.32	+0.21	. . .	. . .	. . .
π Leonis . . .	9 53 36.405	+.004	. . .	–.005	+ 8 38 35.41	–0.69	. . .	. . .	–0.73
η Leonis . . .	10 0 30.942	+.054	. . .	+.023	+17 22 16.49	+0.02	. . .	+0.03	+0.29
α Leonis . . .	10 1 42.818	–.018	. . .	–.012	+12 34 37.79	+0.28	. . .	+0.28	+0.19
λ Ursæ Majoris .	10 9 33.083	+.000	. . .	. . .	+43 32 15.46	–0.06	. . .	+0.13	. . .
μ Ursæ Majoris .	10 14 52.567	–.003	. . .	. . .	+42 7 37.91	+0.27	. . .	+0.25	. . .
31 Leonis Minoris	10 20 39.023	–.009	. . .	. . .	+37 20 49.09	–0.09	. . .	. . .	. . .
9 H. Draconis .	10 24 24.847	–.052	. . .	. . .	+76 21 21.29	–0.38	. . .	–0.45	–0.46
ϱ Leonis . . .	10 26 13.699	+.003	. . .	+.009	+ 9 56 56.58	+0.32	. . .	+0.10	+0.11
35 H. Ursæ Majoris	10 34 5.381	–.008	. . .	. . .	+69 43 44.91	+0.04	. . .	. . .	. . .
42 Leonis Minoris	10 38 54.647	–.026	. . .	. . .	+31 20 24.79	–0.36	. . .	. . .	. . .
ι Leonis . . .	10 42 41.158	+.001	. . .	–.004	+11 12 21.35	+0.32	. . .	+0.34	+0.35
Br. 1508 . . .	10 49 53.400	+.076	. . .	. . .	+78 26 20.43	+0.54	. . .	. . .	. . .
α Ursæ Majoris .	10 55 59.864	+.014	. . .	. . .	+62 25 30.97	+0.44	. . .	+0.40	+0.43
χ Leonis . . .	10 58 34.105	–.001	. . .	–.001	+ 8 0 40.73	–0.04	. . .	. . .	–0.21
ψ Ursæ Majoris .	11 2 37.779	–.006	. . .	. . .	+45 10 34.38	+0.16	. . .	+0.10	. . .
δ Leonis . . .	11 7 27.512	+.001	. . .	–.001	+21 12 29.68	–0.06	. . .	–0.17	–0.21
ξ Ursæ Maj. med.	11 11 30.709	–.044	. . .	. . .	+32 13 55.45	+0.03	. . .	. . .	. . .
σ Leonis . . .	11 14 41.417	+.016	. . .	+.018	+ 6 42 50.86	–0.40	. . .	. . .	–0.34
Groom. 1771 .	11 15 24.611	+.012	. . .	. . .	+65 0 50.76	+0.51	. . .	. . .	. . .

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	h. m. s.	s.	s.	s.	° ′ ″	″	″	″	″
λ Draconis . .	11 23 57.701	+.023	. . .	. . .	+70 1 15.42	−0.57	. . .	−0.69	−0.69
υ Leonis . . .	11 30 32.918	+.009	. . .	+.008	− 0 8 2.48	+0.80	. . .	+0.55	+0.62
3 Draconis . .	11 35 29.052	+.031	. . .	. . .	+67 26 11.51	+0.52	. . .	. . .	. . .
χ Ursæ Majoris .	11 39 26.630	−.020	. . .	. . .	+48 28 20.65	+0.04	. . .	−0.01	. . .
β Leonis . . .	11 42 40.965	−.007	. . .	−.006	+15 16 14.77	−0.27	. . .	−0.32	−0.33
β Virginis . . .	11 44 11.044	−.019	. . .	−.015	+ 2 28 8.77	−0.35	. . .	−0.56	−1.09
γ Ursæ Majoris .	11 47 14.868	−.016	. . .	+.019	+54 23 23.32	−0.34	. . .	−0.46	−0.39
ο Virginis . . .	11 58 50.470	+.027	. . .	−.002	+ 9 25 38.18	+0.03	. . .	+0.01	+0.02
Groom. 1852 .	11 58 52.145	−.048	. . .	. . .	+77 36 17.38	+0.44	. . .	. . .	. . .
4 H. Draconis .	12 6 19.150	−.059	. . .	. . .	+78 18 40.31	−0.61	. . .	−0.85	−0.87
η Virginis . . .	12 13 30.666	−.003	. . .	+.000	+ 0 1 40.23	+0.29	. . .	+0.32	+0.39
κ Draconis. . .	12 28 8.214	−.035	. . .	. . .	+70 28 39.42	−0.40	. . .	−0.47	−0.47
γ Virginis . . .	12 35 19.567	+.059	. . .	+.066	− 0 45 48.60	−0.44	. . .	. . .	−0.67
ε Ursæ Majoris .	12 48 31.498	−.027	−.016	. . .	+56 38 19.03	−0.09	−0.43	−0.23	. . .
12 Canum. Ven. seq.	12 50 10.710	−.001	−.010	−.004	+38 59 39.21	−1.36	−1.30	−1.54	−1.44
8 Draconis . .	12 50 29.640	−.020	−.057	. . .	+66 7 1.40	−0.32	−0.43	. . .	. . .
ε Virginis . . .	12 55 57.266	+.009	+.028	. . .	+11 37 53.04	+0.00	−0.12	. . .	. . .
θ Virginis . . .	13 3 28.750	−.013	. . .	−.014	− 4 52 15.90	−0.02	. . .	−0.45	+0.04
43 Comæ . . .	13 6 2.339	+.017	+.001	. . .	+28 30 44.10	−0.12	−0.26	−0.06	. . .
ζ Ursæ Majoris pr.	13 18 53.390	−.033	+.026	. . .	+55 34 43.13	+0.07	−0.16	−0.10	. . .
Groom. 2001 .	13 22 56.909	+.055	. . .	. . .	+73 2 26.95	+0.81	. . .	+0.99	. . .
ζ Virginis . . .	13 28 19.475	+.001	. . .	+.003	+ 0 2 37.52	+0.48	. . .	+0.31	+0.39
Groom. 2029 .	13 34 11.050	−.054	. . .	. . .	+71 52 42.74	+0.53	. . .	. . .	. . .
η Ursæ Majoris .	13 42 36.813	+.013	+.023	+.013	+49 56 15.90	+0.11	+0.20	−0.12	−0.03
10 ι Draconis . .	13 47 46.880	+.028	+.089	. . .	+65 20 29.34	−0.84	−0.88	. . .	. . .
η Bootis . . .	13 48 43.963	+.019	+.017	+.020	+19 1 30.28	+0.14	−0.10	+0.01	−0.02
τ Virginis . . .	13 55 17.147	+.000	. . .	. . .	+ 2 9 1.05	−0.44	. . .	. . .	. . .
α Draconis . .	14 1 0.377	−.024	−.006	. . .	+64 58 25.99	−0.23	−0.23	−0.58	−0.57
d Bootis . . .	14 4 41.899	−.014	−.004	. . .	+25 41 4.74	+0.02	−0.21	+0.06	. . .
4 Ursæ Minoris .	14 9 21.996	+.038	. . .	. . .	+78 8 7.23	−1.55	. . .	. . .	. . .
α Bootis . . .	14 9 57.622	+.007	+.000	+.008	+19 50 2.19	+0.41	+0.60	+0.28	+0.25
θ Bootis . . .	14 20 56.495	−.008	+.022	+.019	+52 25 45.09	+0.14	+0.08	+0.04	+0.10
ρ Bootis . . .	14 26 26.580	−.005	−.013	+.022	+30 55 15.95	−0.37	−0.31	−0.46	−0.34
γ Bootis . . .	14 27 2.672	−.011	+.033	. . .	+38 51 21.19	−0.23	−0.38	−0.13	. . .
π Bootis pr. . .	14 34 51.119	+.003	−.053	. . .	+16 57 18.71	−0.19	−0.15	. . .	. . .
ζ Bootis med. .	14 35 10.829	−.031	−.018	. . .	+14 15 55.82	+0.22	+0.01	. . .	. . .
109 Virginis . . .	14 39 55.821	−.004	. . .	. . .	+ 2 25 13.49	+1.31	. . .	. . .	. . .
Groom. 2164 .	14 48 16.196	−.087	−.117	. . .	+59 48 9.33	+0.07	+0.62	+0.39	. . .
β Ursæ Minoris .	14 51 5.463	−.042	. . .	. . .	+74 39 58.64	+0.26	. . .	+0.29	+0.28
2 H. Ursæ Minoris	14 55 36.145	−.018	+.034	. . .	+66 25 50.71	+0.25	+0.26	. . .	. . .
β Bootis . . .	14 57 14.275	−.001	−.015	−.006	+40 53 4.37	+0.03	+0.15	−0.16	−0.07
ψ Bootis . . .	14 59 5.372	+.012	+.016	. . .	+27 26 9.64	+0.19	+0.10	. . .	. . .
β Libræ . . .	15 10 16.923	+.018	. . .	+.015	− 8 55 13.12	−0.05	. . .	−0.22	−0.24
δ Bootis . . .	15 10 27.825	−.002	+.036	. . .	+33 46 55.11	+0.93	+1.05	. . .	. . .
1 H. Ursæ Minoris	15 13 12.671	−.054	−.028	. . .	+67 49 18.26	−0.13	+0.21	. . .	. . .

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	h. m. s.	s.	s.	s.	° ′ ″	″	″	″	″
γ Ursæ Minoris .	15 20 56.525	+.035	. . .	. . .	+72 16 43.69	+0.09	. . .	+0.04	+0.03
β Coronæ . . .	15 22 40.548	+.009	+.000	. . .	+29 32 15.80	–0.34	–0.46	–0.50	. . .
ν Bootis pr. .	15 26 26.389	+.018	–.007	. . .	+41 15 36.32	+0.04	–0.39	+0.25	. . .
ν Bootis seq. . .	15 27 18.530	–.004	–.068	. . .	+41 19 28.12	+0.06	–0.39	+0.14	. . .
α Coronæ . . .	15 29 23.760	–.001	–.009	+.014	+27 8 11.61	–0.08	–0.17	–0.10	–0.13
α Serpentis . .	15 38 6.693	+.018	. . .	+.020	+ 6 49 12.71	+0.02	. . .	–0.02	+0.03
β Serpentis . .	15 40 25.143	–.005	+.027	. . .	+15 48 52.48	–0.71	–0.73	–0.64	. . .
μ Serpentis . .	15 43 5.840	+.034	. . .	. . .	– 3 2 46.29	+0.07	. . .	. . .	. . .
ε Serpentis . .	15 44 35.128	+.015	. . .	+.034	+ 4 51 18.37	+0.95	. . .	+1.07	+1.14
ζ Ursæ Minoris .	15 48 33.866	–.078	. . .	. . .	+78 10 40.64	+0.26	. . .	+0.25	+0.23
γ Serpentis . .	15 50 40.791	–.036	+.018	. . .	+16 4 15.85	–0.43	–0.20	. . .	. . .
Groom. 2296 .	15 54 49.547	+.018	–.047	. . .	+55 6 12.94	–0.05	–0.08	+0.12	. . .
θ Draconis . .	15 59 32.928	+.093	+.040	. . .	+58 53 58.71	–0.01	+0.13	–0.06	. . .
δ Ophiuchi . .	16 7 47.778	–.008	. . .	–.007	– 3 22 15.05	–0.10	. . .	–0.16	–0.14
ε Ophiuchi . .	16 11 42.519	–.006	. . .	. . .	– 4 23 9.94	–0.61	. . .	. . .	. . .
19 Ursæ Minoris .	16 14 24.796	–.027	. . .	. . .	+76 11 29.15	–0.14	. . .	. . .	. . .
γ Herculis . . .	16 16 24.387	–.011	–.008	. . .	+19 26 52.53	+0.30	+0.35	+0.67	. . .
ω Herculis . . .	16 19 38.875	–.012	–.030	. . .	+14 19 20.76	+0.06	+0.67	. . .	. . .
η Draconis . .	16 22 18.077	+.141	+.120	. . .	+61 47 50.90	+0.09	+0.16	+0.27	+0.30
λ Ophiuchi . .	16 24 36.598	–.008	. . .	. . .	+ 2 15 32.40	+0.04	. . .	+0.06	. . .
A Draconis . .	16 28 14.132	–.056	–.038	. . .	+69 2 18.79	+0.06	–0.12	–0.41	–0.39
Groom. 2373 .	16 36 2.923	–.053	. . .	. . .	+77 41 37.95	+0.23	. . .	. . .	. . .
ζ Herculis . .	16 36 34.482	+.015	+.061	. . .	+31 49 49.46	–0.08	–0.19	–0.02	. . .
η Herculis . .	16 38 36.681	+.020	+.029	–.026	+39 9 39.75	+0.26	+0.06	+0.11	+0.17
Groom. 2377 .	16 42 55.637	+.093	+.075	. . .	+57 0 21.30	–0.33	–0.29	–0.28	. . .
49 Herculis . . .	16 46 23.436	+.009	–.018	. . .	+15 11 8.14	–0.44	–0.60	. . .	. . .
κ Ophiuchi . .	16 51 45.127	–.004	. . .	+.016	+ 9 34 15.05	+0.15	. . .	+0.21	+0.23
ε Herculis . . .	16 55 30.467	–.002	+.007	. . .	+31 6 41.99	–0.04	–0.05	+0.15	. . .
ε Ursæ Minoris .	16 58 50.789	+.021	. . .	. . .	+82 14 22.45	+0.26	. . .	+0.16	+0.14
Groom. 2415 .	17 3 42.190	–.047	–.057	. . .	+40 40 49.69	–0.29	–0.07	. . .	. . .
α Herculis . . .	17 8 56.918	–.018	–.016	–.016	+14 32 3.35	–0.04	+0.29	+0.23	+0.23
π Herculis . . .	17 10 41.657	–.013	+.031	. . .	+36 57 4.10	–0.28	–0.21	–0.50	. . .
β Draconis . .	17 27 36.553	+.019	+.016	+.017	+52 23 40.69	+0.10	+0.28	–0.12	–0.05
α Ophiuchi . .	17 29 7.953	+.002	+.002	+.003	+12 39 9.37	–0.19	+0.16	–0.12	–0.11
f Draconis . .	17 32 27.990	+.002	–.003	. . .	+68 12 52.26	–0.14	–0.09	. . .	. . .
ω Draconis . .	17 37 41.045	+.068	+.053	. . .	+68 48 55.68	+0.10	+0.09	+0.15	+0.16
μ Herculis . . .	17 41 34.009	+.037	+.022	+.034	+27 47 41.71	+0.36	+0.43	+0.42	+0.40
ψ Drac. Aust. .	17 44 9.890	+.007	. . .	. . .	+72 12 34.52	–0.02	. . .	–0.17	–0.17
γ Draconis . .	17 53 42.247	–.003	+.056	–.008	+51 30 15.34	+0.05	+0.30	. . .	+0.17
35 Draconis . .	17 55 2.807	+.023	. . .	. . .	+76 58 39.71	+0.32	. . .	+0.66	. . .
ο Herculis . . .	18 2 40.039	–.012	–.027	. . .	+28 44 47.71	+0.06	–0.37	–0.22	. . .
δ Ursæ Minoris .	18 12 39.224	+.039	. . .	. . .	+86 36 27.43	+0.29	. . .	+0.28	+0.25
η Serpentis . .	18 14 50.542	–.014	. . .	–.005	– 2 55 46.15	+0.05	. . .	+0.40	+0.43
109 Herculis . . .	18 18 22.297	+.011	–.031	. . .	+21 42 51.61	–0.20	–0.10	. . .	. . .
b Draconis . .	18 22 4.979	+.099	+.062	. . .	+58 43 42.76	+0.55	+1.07	+0.85	. . .

NAME OF STAR.	Right Ascensions for 1875.0.	Auwers *minus* H. C. O.	Safford *minus* H. C. O.	Newcomb *minus* H. C. O.	Declinations for 1875.0.	Auwers *minus* H. C. O.	Safford *minus* H. C. O.	Boss *minus* H. C. O.	Newcomb *minus* H. C. O.
	h. m. s.	s.	s.	s.	° ′ ″	″	″	″	″
φ Draconis . .	18 22 32.856	+.052	. . .	. . .	+71 16 15.31	−0.21	. . .	. . .	. . .
χ Draconis . .	18 23 18.569	−.027	. . .	. . .	+72 40 41.10	−0.06	. . .	−0.04	. . .
α Lyræ	18 32 42.392	+.003	+.000	−.002	+38 40 6.67	−0.30	−0.26	−0.56	−0.50
Groom. 2655 .	18 35 46.483	+.125	. . .	. . .	+77 26 52.30	−0.59	. . .	. . .	. . .
110 Herculis . . .	18 40 16.926	+.033	+.076	. . .	+20 25 41.22	−0.31	−0.62	−0.14	. . .
β Lyræ	18 45 27.840	+.086	+.053	+.079	+33 13 6.83	+0.65	+0.82	+0.34	+0.36
13 R. Lyræ . . .	18 51 31.927	−.026	−.032	. . .	+43 46 56.67	−0.22	−0.43	. . .	. . .
ε Aquilæ . . .	18 53 56.953	+.029	+.018	. . .	+14 53 59.96	−0.03	−0.12	+0.02	. . .
ζ Aquilæ . . .	18 59 39.911	−.011	−.039	−.005	+13 40 44.47	+0.18	+0.16	+0.35	+0.36
ω Aquilæ . . .	19 11 56.967	−.004	+.010	. . .	+11 22 16.60	+0.56	+0.72	. . .	. . .
δ Draconis . .	19 12 31.335	−.046	−.007	. . .	+67 26 29.63	+0.41	+0.74	+0.51	+0.51
ϰ Cygni . . .	19 14 12.809	+.018	−.038	. . .	+53 8 19.00	−0.40	−0.40	−0.54	. . .
τ Draconis . .	19 17 56.730	+.002	. . .	. . .	+73 7 21.71	+0.54	. . .	+0.46	+0.53
δ Aquilæ . . .	19 19 11.757	−.006	. . .	−.016	+ 2 52 2.56	−1.05	. . .	−0.95	−0.89
β Cygni . . .	19 25 40.851	−.007	−.011	. . .	+27 41 54.35	−0.42	−0.21	−0.13	. . .
Groom. 2900 .	19 29 13.082	−.156	. . .	. . .	+79 21 0.90	+0.21	. . .	. . .	. . .
γ Aquilæ . . .	19 40 19.016	+.000	+.011	+.004	+10 18 36.11	−0.04	−0.10	+0.01	+0.01
δ Sagittæ . . .	19 41 48.870	−.023	+.110	. . .	+18 13 37.28	+0.68	+1.19	. . .	. . .
α Aquilæ . . .	19 44 41.054	+.007	. . .	+.011	+ 8 32 22.82	−0.27	. . .	−0.25	−0.23
η Aquilæ . . .	19 46 6.300	−.012	. . .	. . .	+ 0 41 9.98	+0.69	. . .	. . .	. . .
ε Draconis . .	19 48 35.280	−.046	−.049	. . .	+69 56 58.27	+0.01	+0.20	+0.21	+0.20
β Aquilæ . . .	19 49 10.392	−.009	. . .	−.005	+ 6 5 45.62	−0.19	. . .	−0.35	−0.29
λ Ursæ Minoris .	19 49 16.178	+.635	. . .	. . .	+88 55 51.86	−0.37	. . .	−0.24	−0.28
θ Aquilæ . . .	20 4 51.302	−.023	. . .	. . .	− 1 11 27.03	−0.10	. . .	. . .	. . .
ϰ Cephei . . .	20 13 3.809	−.036	. . .	. . .	+77 20 2.38	−0.15	. . .	+0.17	+0.15
γ Cygni . . .	20 17 44.553	+.029	−.004	+.073	+39 51 27.32	−0.40	−0.30	−0.53	−0.50
ε Delphini . . .	20 27 14.456	+.012	−.011	+.021	+10 52 46.35	+0.24	+0.37	+0.63	+0.63
β Delphini . .	20 31 41.232	+.014	−.030	. . .	+14 9 40.87	+0.26	+0.46	+0.01	. . .
73 Draconis . .	20 33 7.956	+.116	. . .	. . .	+74 31 33.11	−0.05	. . .	. . .	. . .
α Delphini . . .	20 33 49.954	−.025	−.016	. . .	+15 28 19.98	−0.03	+0.16	+0.14	. . .
α Cygni . . .	20 37 10.278	+.005	+.027	−.008	+44 50 3.74	+0.25	+0.55	+0.18	+0.27
ε Cygni . . .	20 41 9.233	+.022	+.035	. . .	+33 30 10.06	+0.47	+0.70	+0.34	. . .
η Cephei . . .	20 42 44.656	+.015	+.055	. . .	+61 21 13.29	−0.01	+0.07	+0.16	. . .
32 Vulpeculæ . .	20 49 14.003	+.013	+.001	. . .	+27 34 58.81	+0.36	+0.53	. . .	. . .
76 Draconis . .	20 51 30.604	+.075	. . .	. . .	+82 4 0.44	−0.77	. . .	. . .	. . .
ν Cygni . . .	20 52 30.864	−.022	+.008	−.045	+40 41 11.08	+1.01	+1.14	+1.06	+1.14
Br. 2749 . .	20 53 11.574	−.022	. . .	. . .	+80 4 56.69	−0.17	. . .	−0.26	−0.28
61 Cygni pr. . .	21 1 17.727	−.041	−.028	−.015	+38 8 8.60	−0.22	+0.00	−0.18	−0.12
ζ Cygni . . .	21 7 37.046	−.034	+.007	−.046	+29 42 54.91	−0.63	−0.70	−0.73	−0.73
77 Draconis . .	21 7 57.570	−.011	. . .	. . .	+77 37 8.12	+0.06	. . .	. . .	. . .
τ Cygni . . .	21 9 48.153	−.009	−.003	. . .	+37 30 45.33	−0.15	+0.36	+0.19	. . .
α Cephei . . .	21 15 35.688	+.020	+.042	. . .	+62 3 23.08	−0.22	−0.22	−0.02	+0.01
β Aquarii . . .	21 24 58.685	−.021	. . .	−.023	− 6 7 10.83	−1.54	. . .	−1.49	−1.53
β Cephei . . .	21 27 2.444	+.013	−.068	. . .	+70 0 43.95	+0.02	−0.18	−0.04	−0.04
ε Pegasi . . .	21 38 2.801	+.014	. . .	+.018	+ 9 18 10.05	−0.15	. . .	−0.09	−0.07

NAME OF STAR.	Right Ascensions for 1875.0.	Auwers *minus* H. C. O.	Safford *minus* H. C. O.	Newcomb *minus* H. C. O.	Declinations for 1875.0.	Auwers *minus* H. C. O.	Safford *minus* H. C. O.	Boss *minus* H. C. O.	Newcomb *minus* H. C. O.
	h. m. s.	s.	s.	s.	° ′ ″	″	″	″	″
11 Cephei . . .	21 40 5.015	+.018	. . .	. . .	+70 44 10.41	−0.14	. . .	−0.26	−0.27
π^2 Cygni . . .	21 42 10.618	−.003	−.013	. . .	+48 43 55.08	−0.77	−0.83	. . .	. . .
16 Pegasi . . .	21 47 22.554	−.014	−.028	. . .	+25 20 16.00	−0.25	−0.37	−0.33	. . .
α Aquarii . . .	21 59 21.787	+.007	. . .	+.007	− 0 55 35.66	+0.78	. . .	+0.76	+0.83
ι Pegasi . . .	22 1 11.580	+.000	−.006	. . .	+24 44 6.35	+0.35	+0.58	+0.45	. . .
θ Pegasi . . .	22 3 53.663	+.006	. . .	. . .	+ 5 35 1.45	−0.63	. . .	. . .	. . .
ζ Cephei . . .	22 6 31.177	−.011	−.026	. . .	+57 35 7.94	+0.04	+0.18	+0.02	. . .
24 Cephei . . .	22 7 24.018	+.010	. . .	. . .	+71 43 32.89	−0.19	. . .	. . .	. . .
θ Aquarii . . .	22 10 14.195	+.033	. . .	+.009	− 8 24 18.28	+0.35	. . .	+0.15	+0.13
γ Aquarii . . .	22 15 11.969	+.004	. . .	. . .	− 2 1 59.97	+0.28	. . .	+0.51	. . .
3 Lacertæ . . .	22 18 38.856	−.023	−.018	. . .	+51 36 11.68	−0.01	+0.06	. . .	. . .
7 Lacertæ . . .	22 26 8.684	−.011	+.014	. . .	+49 38 25.37	−0.46	−0.38	−0.34	. . .
η Aquarii . . .	22 28 55.965	+.006	. . .	+.001	− 0 45 40.96	+0.44	. . .	+0.54	+0.61
31 Cephei . . .	22 32 40.788	+.077	. . .	. . .	+72 59 40.33	+0.15	. . .	. . .	. . .
ζ Pegasi . . .	22 35 13.683	+.018	−.003	+.017	+10 10 45.28	+0.11	+0.23	+0.30	+0.30
η Pegasi . . .	22 37 8.684	+.001	+.002	. . .	+29 34 4.92	−0.34	−0.38	−0.53	. . .
13 Lacertæ . . .	22 38 31.173	−.001	+.014	. . .	+41 9 48.56	+0.08	+0.26	. . .	. . .
λ Pegasi . . .	22 40 30.709	−.006	−.033	. . .	+22 54 29.82	+0.03	−0.10	−0.15	. . .
μ Pegasi . . .	22 43 58.291	+.011	−.015	. . .	+23 56 30.86	+0.10	+0.17	+0.20	. . .
ι Cephei . . .	22 45 14.069	+.026	+.031	. . .	+65 32 35.76	−0.14	−0.49	−0.09	−0.09
λ Aquarii . . .	22 46 5.560	−.015	. . .	+.010	− 8 14 39.89	+0.15	. . .	+0.47	+0.44
o Andromedæ .	22 56 10.396	−.004	−.006	. . .	+41 39 15.49	+0.61	+0.54	+0.23	. . .
α Pegasi . . .	22 58 32.139	−.023	−.032	−.017	+14 31 59.06	−0.12	−0.42	−0.23	−0.24
π Cephei . . .	23 3 55.647	−.047	. . .	. . .	+74 42 42.33	+0.62	. . .	. . .	. . .
γ Piscium . . .	23 10 41.157	−.036	. . .	+.333	+ 2 35 58.74	−0.38	. . .	. . .	−0.52
τ Pegasi . . .	23 14 27.114	−.001	+.013	. . .	+23 3 22.78	−0.17	−0.16	. . .	. . .
v Pegasi . . .	23 19 8.428	+.096	+.129	. . .	+22 42 58.14	−0.17	−0.32	. . .	. . .
λ Andromedæ .	23 31 27.068	+.029	+.035	. . .	+45 46 50.86	+0.53	+0.34	+0.96	. . .
ι Piscium . . .	23 33 31.311	−.021	. . .	−.022	+ 4 56 56.72	−0.93	. . .	−0.71	−0.66
γ Cephei . . .	23 34 14.013	−.013	. . .	. . .	+76 56 4.98	−0.13	. . .	+0.01	−0.01
41 H. Cephei . .	23 41 56.777	−.065	−.075	. . .	+67 6 44.11	+0.38	+0.36	+0.14	. . .
φ Pegasi . . .	23 46 7.827	+.013	+.009	. . .	+18 25 33.62	+0.04	+0.36	. . .	. . .
ϱ Cassiopeiæ . .	23 48 8.799	+.013	+.049	. . .	+56 48 13.48	+0.20	+0.52	. . .	. . .
ω Piscium . . .	23 52 53.570	+.013	. . .	+0.24	+ 6 10 16.65	−0.19	. . .	−0.36	−0.31

CATALOGUE OF 284 SECONDARY STARS

OBSERVED DURING THE YEARS 1871, 1872, 1874, AND 1875,

WITH THE

MERIDIAN CIRCLE OF HARVARD COLLEGE OBSERVATORY,

AND REDUCED TO THE FUNDAMENTAL SYSTEM OF AUWERS,

FOR THE EPOCH 1875.0.

NAME OF STAR.	Right Ascensions for 1875.0.	Auwers *minus* H. C. O.	Safford *minus* H. C. O.	Newcomb *minus* H. C. O.	Declinations for 1875.0.	Auwers *minus* H. C. O.	Safford *minus* H. C. O.	Boss *minus* H. C. O.	Newcomb *minus* H. C. O.
	h. m. s.	s.	s.	s.	° ′ ″	″	″	″	″
35 Piscium . . .	0 8 32.602	. . .	. . .	. . .	+ 8 7 36.19	. . .	. . .	. . .	. . .
θ Andromedæ .	0 10 33.981	. . .	–.092	. . .	+37 59 15.20	. . .	–0.10	. . .	. . .
ι Sculptoris . .	0 15 14.179	. . .	. . .	. . .	–29 40 22.29	. . .	. . .	. . .	. . .
12 Cassiopeiæ . .	0 17 54.521	. . .	+.024	. . .	+61 8 17.10	. . .	+0.36	. . .	. . .
Piazzi 0.79 . .	0 21 43.601	. . .	. . .	. . .	–33 41 51.53	. . .	. . .	. . .	. . .
Piazzi, 0.130 .	0 30 55.365	. . .	. . .	. . .	–25 27 19.41	. . .	. . .	. . .	. . .
ξ Cassiopeiæ . .	0 35 6.035	. . .	–.052	. . .	+49 49 36.22	. . .	–0.46	. . .	. . .
β Ceti	0 37 18.928	–.053	. . .	–.056	–18 40 23.06	–0.79	. . .	–0.74	–0.75
ν Andromedæ .	0 42 55.591	. . .	–.084	. . .	+40 23 51.56	. . .	+0.56	. . .	. . .
Piazzi, 0.207 .	0 44 52.164	. . .	. . .	–.016	+ 2 42 24.03	. . .	. . .	. . .	–0.75
20 Ceti	0 46 37.206	. . .	. . .	–.044	– 1 49 25.10	. . .	. . .	. . .	+0.50
α Sculptoris . .	0 52 34.879	. . .	. . .	. . .	–30 2 00.74	. . .	. . .	. . .	. . .
μ Cassiopeiæ . .	0 59 58.182	. . .	–.181	. . .	+54 18 21.53	. . .	–0.12	. . .	. . .
37 Ceti	1 8 6.299	. . .	. . .	. . .	– 8 35 43.08	. . .	. . .	. . .	. . .
ω Andromedæ .	1 20 11.101	. . .	+.008	. . .	+44 45 37.14	. . .	+0.14	. . .	. . .
38 Cassiopeiæ . .	1 21 57.489	. . .	+.010	. . .	+69 37 13.52	. . .	–0.45	–0.53	. . .
Piazzi, 1.109 .	1 27 20.439	. . .	. . .	. . .	–37 30 29.55	. . .	. . .	. . .	. . .
τ Andromedæ .	1 33 12.470	. . .	+.048	. . .	+39 56 34.65	. . .	+0.57	. . .	. . .
Piazzi, I. 170 .	1 41 16.704	. . .	–.091	. . .	+37 19 45.96	. . .	+0.33	. . .	. . .
χ Ceti	1 43 26.802	. . .	. . .	. . .	–11 18 20.62	. . .	. . .	. . .	. . .
ζ Ceti	1 45 17.461	–.008	. . .	. . .	–10 57 12.91	+0.35	. . .	. . .	. . .
λ Arietis pr. . .	1 50 58.007	. . .	–.035	. . .	+22 59 7.46	. . .	–0.84	. . .	. . .
υ Ceti	1 54 6.932	–.006	. . .	. . .	–21 41 4.62	–0.11	. . .	. . .	. . .
27 Arietis . . .	2 23 58.513	. . .	. . .	+.033	+17 8 58.70	. . .	. . .	. . .	+0.35
σ Ceti	2 26 9.792	. . .	. . .	. . .	–15 47 40.02	. . .	. . .	. . .	. . .
τ¹ Eridani . . .	2 39 16.150	. . .	. . .	. . .	–19 6 11.36	. . .	. . .	. . .	. . .
12 Eridani . . .	3 6 45.715	–.005	. . .	. . .	–29 28 51.16	–0.89	. . .	. . .	. . .
ζ Eridani . . .	3 9 45.753	. . .	. . .	. . .	– 9 17 7.86	. . .	. . .	. . .	. . .
κ Ceti	3 12 48.412	. . .	. . .	. . .	+ 2 54 37.16	. . .	. . .	. . .	. . .
δ Eridani . . .	3 37 15.689	–.024	. . .	. . .	–10 11 18.20	+0.81	. . .	. . .	. . .

NAME OF STAR.	Right Ascensions for 1875.0.	Auwers *minus* H. C. O.	Safford *minus* H. C. O.	Newcomb *minus* H. C. O.	Declinations for 1875.0.	Auwers *minus* H. C. O.	Safford *minus* H. C. O.	Boss *minus* H. C. O.	Newcomb *minus* H. C. O.
	h. m. s.	s.	s.	s.	° ′ ″	″	″	″	″
τ^7 Eridani . . .	3 42 17.113	. . .	. . .	. . .	−24 15 48.99	. . .	. . .	. . .	. . .
Piazzi, III. 183	3 43 59.103	. . .	. . .	. . .	−38 0 14.53	. . .	. . .	. . .	. . .
γ Eridani . . .	3 52 11.913	−.035	. . .	−.015	−13 51 55.91	−0.57	. . .	−0.57	−0.58
λ Persei . . .	3 57 16.729	. . .	. . .	. . .	+50 0 34.28	. . .	. . .	+0.27	. . .
Piazzi, III. 249 .	4 0 50.047	. . .	. . .	−.033	+17 0 14.26	. . .	. . .	. . .	−0.19
p Tauri	4 3 13.274	. . .	. . .	. . .	+26 9 10.32	. . .	. . .	. . .	. . .
o^2 Eridani . . .	4 9 31.091	. . .	. . .	. . .	− 7 50 56.81	. . .	. . .	. . .	. . .
64 Tauri	4 16 53.468	. . .	. . .	. . .	+17 9 8.66	. . .	. . .	. . .	. . .
υ^3 Eridani . . .	4 19 20.501	. . .	. . .	. . .	−34 18 30.59	. . .	. . .	. . .	. . .
80 Tauri	4 23 1.035	. . .	. . .	+.002	+15 21 46.53	. . .	. . .	. . .	−1.19
85 Tauri	4 24 43.435	. . .	. . .	+.046	+15 34 52.50	. . .	. . .	. . .	+0.36
ρ Tauri	4 26 45.372	. . .	. . .	−.082	+14 34 46.46	. . .	. . .	. . .	−0.60
53 Eridani . . .	4 32 27.381	. . .	. . .	. . .	−14 32 59.80	. . .	. . .	. . .	. . .
π^3 Orionis . . .	4 43 3.329	. . .	. . .	. . .	+ 6 44 28.77	. . .	. . .	. . .	. . .
o^1 Orionis . . .	4 45 27.751	. . .	. . .	. . .	+14 2 25.30	. . .	. . .	. . .	. . .
ν Leporis . . .	5 14 11.033	. . .	. . .	. . .	−12 26 44.28	. . .	. . .	. . .	. . .
m Orionis . . .	5 16 15.865	. . .	. . .	. . .	+ 3 25 20.19	. . .	. . .	. . .	. . .
ψ Orionis . . .	5 20 17.310	. . .	. . .	. . .	+ 2 59 7.85	. . .	. . .	. . .	. . .
α Leporis . . .	5 27 13.041	+.001	. . .	+.010	−17 54 47.62	−0.94	. . .	−1.00	−1.00
ζ Leporis . . .	5 41 17.492	+.023	. . .	. . .	−14 52 13.32	+0.44	. . .	. . .	. . .
β Columbæ . .	5 46 33.181	. . .	. . .	. . .	−35 49 1.82	. . .	. . .	+1.28	. . .
γ Columbæ . .	5 53 6.343	. . .	. . .	. . .	−35 17 53.45	. . .	. . .	. . .	. . .
μ Orionis . . .	5 55 30.384	. . .	. . .	. . .	+ 9 38 42.14	. . .	. . .	. . .	. . .
Piazzi, V. 327 .	5 58 13.402	. . .	. . .	. . .	−26 17 7.87	. . .	. . .	. . .	. . .
θ Columbæ . .	6 3 14.448	. . .	. . .	. . .	−37 14 12.82	. . .	. . .	. . .	. . .
k Orionis . . .	6 9 25.481	. . .	. . .	. . .	+12 18 17.42	. . .	. . .	. . .	. . .
β Canis Majoris .	6 17 11.693	+.024	. . .	. . .	−17 53 43.93	+0.06	. . .	. . .	. . .
Piazzi, VI. 110	6 19 40.864	. . .	. . .	. . .	−36 38 37.13	. . .	. . .	. . .	. . .
ν Geminorum .	6 21 32.455	. . .	. . .	−.015	+20 17 20.48	. . .	. . .	. . .	+0.19
λ Canis Majoris .	6 23 32.083	. . .	. . .	. . .	−32 30 7.06	. . .	. . .	. . .	. . .
13 Monocerotis .	6 26 8.705	. . .	. . .	. . .	+ 7 25 20.71	. . .	. . .	. . .	. . .
Piazzi, VI. 164	6 27 58.293	. . .	. . .	. . .	−31 56 20.71	. . .	. . .	. . .	. . .
ψ^4 Aurigæ . . .	6 33 59.096	. . .	. . .	. . .	+44 38 30.66	. . .	. . .	. . .	. . .
α Canis Majoris .	6 39 38.304	. . .	. . .	. . .	−16 32 46.33	. . .	. . .	. . .	. . .
ψ^7 Aurigæ . . .	6 41 55.527	. . .	. . .	. . .	+41 55 33.21	. . .	. . .	. . .	. . .
o^1 Canis Majoris .	6 48 56.765	. .	. . .	. . .	−24 1 45.73	. . .	. . .	. . .	. . .
ε Canis Majoris .	6 53 42.841	−.047	. . .	−.025	−28 48 12.42	−0.19	. . .	−0.48	−0.47
γ Canis Majoris .	6 58 6.217	−.035	. . .	. . .	−15 27 0.83	−0.25	. . .	. . .	. . .
δ Canis Majoris .	7 3 18.546	−.008	. . .	−.014	−26 11 47.58	+0.84	. . .	+1.05	+1.07
22 Monocerotis .	7 5 28.853	. . .	. . .	. . .	− 0 17 16.14	. . .	. . .	. . .	. . .
66 Aurigæ . . .	7 15 28.942	. . .	. . .	. . .	+40 54 37.93	. . .	. . .	. . .	. . .
η Canis Majoris .	7 19 9.070	. . .	. . .	. . .	−29 3 38.21	. . .	. . .	. . .	. . .
6 Canis Minoris .	7 28 50.271	. . .	. . .	. . .	+12 15 46.64	. . .	. . .	. . .	. . .
o Geminorum .	7 31 0.221	. . .	. . .	. . .	+34 52 7.41	. . .	. . .	. . .	. . .
26 Monocerotis .	7 35 16.480	. . .	. . .	. . .	− 9 15 41.19	. . .	. . .	. . .	. . .

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	h. m. s.	s.	s.	s.	° ′ ″	″	″	″	″
4 Navis. . . .	7 40 11.482	. . .	. . .	. . .	−14 15 41.41	. . .	. . .	. . .	. . .
o Navis. . . .	7 42 53.393	. . .	. . .	. . .	−25 37 41.39	. . .	. . .	. . .	. . .
φ Geminorum .	7 45 50.698	. . .	. . .	+.010	+27 5 14.82	. . .	. . .	. . .	−0.12
3 H. Ursæ Majoris	8 0 20.865	. . .	. . .	. . .	+68 50 20.75	. . .	. . .	−0.46	−0.47
ι Navis. . . .	8 2 13.211	+.032	. . .	+.038	−23 56 43.10	−0.31	. . .	−0.28	−0.28
ζ Cancri pr. .	8 5 2.492	. . .	. . .	−.005	+18 1 22.62	. . .	. . .	. . .	−2.04
20 Navis. . . .	8 7 35.207	+.047	. . .	. . .	−15 24 46.93	−0.67	. . .	. . .	. . .
w Navis. . . .	8 16 27.710	. . .	. . .	. . .	−32 39 28.92	. . .	. . .	. . .	. . .
B. A. C. 2846 .	8 22 35.380	. . .	. . .	. . .	−25 43 13.73	. . .	. . .	. . .	. . .
B. A. C. 2887 .	8 29 1.563	. . .	. . .	. . .	+53 50 4.85	. . .	. . .	. . .	. . .
δ Hydræ . . .	8 31 2.271	. . .	. . .	. . .	+ 6 8 18.45	. . .	. . .	. . .	. . .
6 Hydræ . . .	8 34 6.109	. . .	. . .	. . .	−12 2 6.14	. . .	. . .	. . .	. . .
γ Cancri . . .	8 36 3.001	. . .	. . .	+.005	+21 54 59.47	. . .	. . .	. . .	−0.35
ϱ Hydræ . . .	8 41 48.648	. . .	. . .	. . .	+ 6 17 53.04	. . .	. . .	. . .	. . .
35 Lyncis . . .	8 43 33.091	. . .	. . .	. . .	+44 11 24.46	. . .	. . .	. . .	. . .
κ Cancri . . .	9 0 58.512	. . .	. . .	+.025	+11 10 11.54	. . .	. . .	+0.19	+0.19
Piazzi,VIII. 265	9 2 33.676	. . .	. . .	. . .	−25 21 18.66	. . .	. . .	. . .	. . .
e Mali	9 4 38.572	. . .	. . .	. . .	−29 51 22.72	. . .	. . .	. . .	. . .
Piazzi, IX. 63 .	9 15 57.591	. . .	. . .	. . .	−25 26 4.58	. . .	. . .	. . .	. . .
42 Lyncis . . .	9 30 33.128	. . .	. . .	. . .	+40 47 59.08	. . .	. . .	. . .	. . .
ι Hydræ . . .	9 33 28.289	. . .	. . .	. . .	− 0 34 35.74	. . .	. . .	. . .	. . .
ψ Leonis . . .	9 36 55.379	. . .	. . .	−.025	+14 35 32.78	. . .	. . .	. . .	−0.60
φ Ursæ Majoris .	9 43 35.350	. . .	. . .	. . .	+54 38 50.43	. . .	. . .	. . .	. . .
B. A. C. 3398 .	9 49 48.306	. . .	. . .	. . .	+ 9 31 28.43	. . .	. . .	. . .	. . .
B. A. C. 3428 .	9 56 29.599	. . .	. . .	. . .	−12 41 42.32	. . .	. . .	. . .	. . .
υ^2 Hydræ . . .	9 59 2.284	. . .	. . .	. . .	−12 27 35.23	. . .	. . .	. . .	. . .
λ Hydræ . . .	10 4 29.676	+.000	. . .	. . .	−11 44 14.78	+1.05	. . .	. . .	. . .
32 Ursæ Majoris .	10 8 55.969	. . .	. . .	. . .	+65 43 51.18	. . .	. . .	−0.49	−0.50
22 Sextantis . .	10 11 25.146	. . .	. . .	. . .	− 7 26 44.29	. . .	. . .	. . .	. . .
γ Leonis pr. . .	10 13 4.762	. . .	. . .	−.033	+20 28 22.93	. . .	. . .	−0.18	−0.18
γ Antliæ . . .	10 18 10.811	. . .	. . .	. . .	−29 1 1.55	. . .	. . .	. . .	. . .
α Antliæ . . .	10 21 25.996	+.038	. . .	. . .	−30 25 56.21	−0.07	. . .	. . .	. . .
48 Leonis . . .	10 28 16.715	. . .	. . .	−.028	+ 7 35 47.61	. . .	. . .	. . .	−0.21
φ Hydræ . . .	10 32 29.585	. . .	. . .	. . .	−16 13 42.19	. . .	. . .	. . .	. . .
36 H. Ursæ Majoris	10 36 11.720	. . .	. . .	. . .	+46 51 37.11	. . .	. . .	. . .	. . .
b^1 Hydræ . . .	10 40 44.701	. . .	. . .	. . .	−16 38 18.63	. . .	. . .	. . .	. . .
ω Ursæ Majoris .	10 46 46.707	. . .	. . .	. . .	+43 51 17.38	. . .	. . .	. . .	. . .
54 Leonis . . .	10 48 50.565	. . .	. . .	. . .	+25 24 56.99	. . .	. . .	. . .	. . .
Piazzi, X. 199 .	10 50 53.697	. . .	. . .	. . .	−36 27 59.93	. . .	. . .	. . .	. . .
α Crateris . . .	10 53 41.134	. . .	. . .	. . .	−17 38 0.74	. . .	. . .	. . .	. . .
p^4 Leonis . . .	11 0 31.636	. . .	. . .	. . .	+ 2 38 1.73	. . .	. . .	. . .	. . .
β Crateris . . .	11 5 30.698	−.002	. . .	. . .	−22 8 38.97	+0.73	. . .	. . .	. . .
n Leonis . . .	11 9 19.484	. . .	. . .	. . .	+13 59 20.11	. . .	. . .	. . .	. . .
δ Crateris . . .	11 13 5.540	−.019	. . .	. . .	−14 6 8.43	−0.69	. . .	−0.76	. . .
λ Crateris . . .	11 17 10.132	. . .	. . .	. . .	−18 5 36.62	. . .	. . .	. . .	. . .

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	h. m. s.	s.	s.	s.	° ′ ″	″	″	″	″
γ Crateris . . .	11 18 38.318	−.018	. . .	. . .	−16 59 52.29	+0.01	. . .	. . .	. . .
τ Leonis . . .	11 21 30.525	. . .	. . .	−.012	+ 3 32 40.71	. . .	. . .	−0.94	−0.95
ξ Hydræ . . .	11 26 51.362	+.052	. . .	. . .	−31 9 58.96	+0.15	. . .	. . .	. . .
B. A. C. 3934 .	11 28 25.218	. . .	. . .	. . .	−32 10 10.86	. . .	. . .	. . .	. . .
B. A. C. 3973 .	11 36 59.828	. . .	. . .	. . .	+42 24 57.60	. . .	. . .	. . .	. . .
b Virginis . . .	11 53 32.767	. . .	. . .	−.008	+ 4 21 5.77	. . .	. . .	. . .	−1.03
67 Ursæ Majoris .	11 55 45.722	. . .	. . .	. . .	+43 44 20.00	. . .	. . .	. . .	. . .
α Corvi	12 1 58.146	. . .	. . .	+.023	−24 1 54.60	. . .	. . .	. . .	+0.63
ε Corvi	12 3 41.896	+.009	. . .	. . .	−21 55 29.30	+0.57	. . .	. . .	. . .
γ Corvi	12 9 22.781	−.003	. . .	+.004	−16 50 51.33	−0.51	. . .	. . .	−1.12
12 Comæ . . .	12 16 13.233	. . .	−.061	. . .	+26 32 24.01	. . .	+0.23	. . .	. . .
13 Comæ . . .	12 18 2.173	. . .	−.005	. . .	+26 47 31.14	. . .	−0.41	. . .	. . .
15 Comæ . . .	12 20 42.368	. . .	−.020	. . .	+28 57 48.02	. . .	+0.62	. . .	. . .
δ Corvi	12 23 23.870	+.064	. . .	. . .	−15 49 9.28	−0.75	. . .	. . .	. . .
η Corvi	12 25 37.770	. . .	. . .	. . .	−15 30 12.32	. . .	. . .	. . .	. . .
β Corvi	12 27 49.432	−.029	. . .	+.003	−22 42 19.00	−0.39	. . .	−0.44	−0.40
f Virginis . . .	12 30 21.095	. . .	. . .	−.005	− 5 8 33.50	. . .	. . .	. . .	−0.87
χ Virginis . . .	12 32 47.728	. . .	. . .	−.007	− 7 18 26.06	. . .	. . .	. . .	−1.07
65 B. Canum . .	12 39 15.169	. . .	−.064	. . .	+46 7 26.22	. . .	+0.29	. . .	. . .
35 Virginis . . .	12 41 29.545	. . .	. . .	. . .	+ 4 15 19.96	. . .	. . .	. . .	. . .
31 Comæ . . .	12 45 36.518	. . .	+.011	. . .	+28 13 16.80	. . .	−0.16	. . .	. . .
36 Comæ . . .	12 52 44.524	. . .	−.007	. . .	+18 5 1.41	. . .	+0.06	. . .	. . .
14 Canum Venat. .	12 59 53.650	. . .	+.057	. . .	+36 28 5.58	. . .	−0.39	. . .	. . .
11 H. Canum Venat.	13 8 2.773	. . .	+.012	. . .	+40 48 54.74	. . .	−0.12	+0.68	. . .
63 Virginis . . .	13 16 19.544	. . .	. . .	. . .	−17 4 47.75	. . .	. . .	. . .	. . .
α Virginis . . .	13 18 36.591	−.026	. . .	−.019	−10 30 29.41	−0.55	. . .	−0.64	−0.64
70 Virginis . . .	13 22 19.025	. . .	−.023	. . .	+14 26 50.67	. . .	−1.54	. . .	. . .
B. A. C. 4513 .	13 24 56.634	. . .	−.102	. . .	+24 52 56.84	. . .	−0.31	−0.21	. . .
25 Canum Venat. .	13 31 54.377	. . .	+.133	. . .	+36 55 52.15	. . .	+0.34	. . .	. . .
m Virginis . . .	13 35 3.208	. . .	. . .	. . .	− 8 4 17.58	. . .	. . .	. . .	. . .
83 Virginis . . .	13 37 45.310	. . .	. . .	+.032	−15 32 58.09	. . .	. . .	. . .	−1.52
87 Virginis . . .	13 40 37.580	. . .	. . .	−.012	−17 13 59.76	. . .	. . .	. . .	+0.15
h Centauri . . .	13 46 1.164	. . .	. . .	. . .	−31 18 34.81	. . .	. . .	. . .	. . .
9 Bootis . . .	13 50 51.737	. . .	−.014	. . .	+28 6 20.82	. . .	+0.12	. . .	. . .
θ Centauri . . .	13 59 19.940	. . .	. . .	. . .	−35 45 16.55	. . .	. . .	. . .	. . .
14 Bootis . . .	14 8 4.528	. . .	+.040	. . .	+13 32 48.54	. . .	−1.31	. . .	. . .
λ Virginis . . .	14 12 20.902	. . .	. . .	+.011	−12 47 41.11	. . .	. . .	. . .	−0.09
Piazzi, XIV. 53	14 14 50.584	. . .	. . .	. . .	−34 12 53.15	. . .	. . .	. . .	. . .
2 Libræ . . .	14 16 42.215	. . .	. . .	−.051	−11 8 31.68	. . .	. . .	. . .	+0.11
B. A. C. 4797 .	14 23 5.901	. . .	+.011	. . .	+36 45 24.82	. . .	+0.47	. . .	. . .
5 Ursæ Minoris .	14 27 48.789	. . .	. . .	. . .	+76 15 6.16	. . .	. . .	−0.03	. . .
Piazzi, XIV. 135	14 32 24.151	. . .	. . .	. . .	−26 10 55.56	. . .	. . .	. . .	. . .
ε Bootis seq. . .	14 39 31.672	. . .	+0.04	+.047	+27 36 7.28	. . .	+0.36	+0.51	+0.52
α Libræ . . .	14 43 57.936	+.011	. . .	+.000	−15 31 16.27	−0.01	. . .	+0.10	+0.11
ξ Bootis . . .	14 45 37.458	. . .	+0.26	. . .	+19 37 13.17	. . .	+0.32	. . .	. . .

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	h. m. s.	s.	s.	s.	° ′ ″	″	″	″	″
δ Libræ . . .	14 54 17.733	. . .	. . .	. . .	− 8 1 17.71	. . .	. . .	. . .	. . .
c Bootis . . .	15 1 48.676	. . .	−.097	. . .	+25 21 25.00	. . .	−0.07	. . .	. . .
ι Libræ . . .	15 5 5.912	+.027	. . .	+.008	−19 19 3.35	+1.02	. . .	. . .	+1.16
25 Libræ . . .	15 6 12.126	. . .	. . .	. . .	−19 10 32.45	. . .	. . .	. . .	. . .
B. A. C. 5009 .	15 6 58.082	. . .	. . .	. . .	−31 3 4.19	. . .	. . .	. . .	. . .
ε Libræ . . .	15 17 25.469	. . .	. . .	. . .	− 9 52 17.49	. . .	. . .	. . .	. . .
ψ^1 Lupi	15 31 49.871	. . .	. . .	. . .	−34 0 8.19	. . .	. . .	. . .	. . .
ψ^2 Lupi	15 34 43.339	. . .	. . .	. . .	−34 18 27.20	. . .	. . .	. . .	. . .
λ Libræ . . .	15 46 4.797	. . .	. . .	−.014	−19 47 29.72	. . .	. . .	. . .	−0.53
δ Scorpii . . .	15 52 56.639	+.044	. . .	+.056	−22 15 51.47	+0.21	. . .	+0.18	+0.19
β Scorpii pr. . .	15 58 10.239	+.018	. . .	+.034	−19 27 41.90	−0.09	. . .	−0.05	−0.05
κ Herculis . . .	16 2 26.051	. . .	. . .	. . .	+17 22 52.12	. . .	+0.05	. . .	. . .
ν Scorpii seq. . .	16 4 43.942	. . .	. . .	−.009	−19 8 2.60	. . .	. . .	. . .	−0.37
Groombr. 2320	16 5 59.338	. . .	−.071	. . .	+68 8 22.24	. . .	+0.33	+0.48	+0.48
α Scorpii . . .	16 21 44.718	+.006	. . .	+.004	−26 9 9.74	−0.23	. . .	−0.15	−0.15
τ Scorpii . . .	16 28 6.183	. . .	. . .	+.043	−27 57 16.66	. . .	. . .	. . .	−0.30
ζ Ophiuchi . .	16 30 16.637	−.019	. . .	−.012	−10 18 43.87	+0.00	. . .	−0.05	−0.06
24 Scorpii . . .	16 34 20.725	. . .	. . .	+.045	−17 29 53.48	. . .	. . .	. . .	−1.68
ι Ophiuchi . .	16 48 5.642	. . .	−.009	. . .	+10 22 21.81	. . .	−0.10	. . .	. . .
η Ophiuchi . .	17 3 12.617	+.000	. . .	−.001	−15 34 5.31	−0.26	. . .	. . .	−0.51
B. A. C. 5804 .	17 7 7.074	. . .	. . .	. . .	−33 24 6.01	. . .	. . .	. . .	. . .
θ Ophiuchi . .	17 14 20.042	−.004	. . .	−.008	−24 52 21.79	−0.17	. . .	. . .	−0.16
w Herculis. . .	17 15 59.022	. . .	−.035	. . .	+32 37 46.00	. . .	−0.75	. . .	. . .
44 Ophiuchi . .	17 18 44.258	. . .	. . .	+.000	−24 3 29.81	. . .	. . .	+0.09	+0.09
υ Scorpii . . .	17 22 15.985	. . .	. . .	. . .	−37 11 38.91	. . .	. . .	. . .	. . .
λ Scorpii . . .	17 25 7.311	. . .	. . .	. . .	−37 0 37.83	. . .	. . .	. . .	. . .
μ Ophiuchi . .	17 31 3.039	. . .	. . .	. . .	− 8 2 26.32	. . .	. . .	. . .	. . .
58 Ophiuchi . .	17 35 56.422	. . .	. . .	+.039	−21 37 13.52	. . .	. . .	. . .	+0.26
3 Sagittarii . .	17 39 41.588	. . .	. . .	−.022	−27 46 51.34	. . .	. . .	. . .	−0.52
Piazzi, XVII. 289	17 48 0.724	. . .	−.003	. . .	+40 0 37.13	. . .	+0.19	. . .	. . .
89 Herculis . . .	17 50 22.659	. . .	+.033	. . .	+26 4 16.52	. . .	+0.01	−0.02	. . .
γ Sagittarii . .	17 57 46.723	+.007	. . .	−.016	−30 25 23.85	−0.32	. . .	−0.54	−0.58
Piazzi, XVII. 359	18 0 10.034	. . .	. . .	. . .	−28 28 7.71	. . .	. . .	. . .	. . .
μ Sagittarii . .	18 6 17.332	−.026	. . .	−.035	−21 5 22.56	+0.17	. . .	+0.36	+0.34
η Sagittarii . .	18 9 10.225	. . .	. . .	. . .	−36 47 49.63	. . .	. . .	. . .	. . .
δ Sagittarii . .	18 12 59.470	. . .	. . .	+.053	−29 52 46.76	. . .	. . .	. . .	+2.38
B. A. C. 6318 .	18 25 58.998	. . .	−.256	. . .	+59 27 58.91	. . .	−0.37	+0.02	. . .
1 Aquilæ . . .	18 28 24.346	. . .	. . .	−.044	− 8 19 46.23	. . .	. . .	−0.71	−0.71
2 Aquilæ . . .	18 35 25.778	. . .	. . .	. . .	− 9 10 12.31	. . .	. . .	. . .	. . .
B. A. C. 6419 .	18 43 55.517	. . .	+.008	. . .	+52 51 4.90	. . .	+0.25	. . .	. . .
σ Sagittarii . .	18 47 30.815	+.026	. . .	+.016	−26 26 59.04	−0.38	. . .	−0.71	−0.70
δ Lyræ	18 49 21.634	. . .	−.013	. . .	+36 48 59.44	. . .	+0.25	. . .	. . .
50 Draconis. . .	18 50 23.936	. . .	. . .	. . .	+75 17 7.87	. . .	. . .	−0.09	−0.09
g Aquilæ . . .	18 56 19.524	. . .	. . .	. . .	− 3 52 40.57	. . .	. . .	. . .	. . .
π Sagittarii . .	19 2 19.785	−.007	. . .	−.006	−21 13 14.31	+0.57	. . .	. . .	+0.86

NAME OF STAR.	Right Ascensions for 1875.0.	Auwers *minus* H. C. O.	Safford *minus* H. C. O.	Newcomb *minus* H. C. O.	Declinations for 1875.0.	Auwers *minus* H. C. O.	Safford *minus* H. C. O.	Boss *minus* H. C. O.	Newcomb *minus* H. C. O.
	h. m. s.	s.	s.	s.	° ′ ″	″	″	″	″
Piazzi, XIX. 4 .	19 4 59.898	...	...	...	–21 51 49.33	...	...	...	...
ψ Sagittarii . .	19 7 52.529	...	...	–.045	–25 28 12.60	...	...	...	+0.04
d Sagittarii . .	19 10 19.276	...	...	–.042	–19 10 24.79	...	...	–0.11	+0.10
χ Sagittarii pr. .	19 17 40.054	...	...	–.008	–24 44 59.75	...	...	...	+2.55
4 Cygni . . .	19 21 39.051	...	–.039	...	+36 4 5.38	...	+0.10	...	...
h^1 Sagittarii . .	19 28 26.225	...	...	–.017	–24 59 27.29	...	...	...	–0.41
h^2 Sagittarii . .	19 29 5.960	–.036	...	–.032	–25 9 27.86	+0.57	...	...	+0.64
κ Aquilæ . . .	19 30 10.022	...	...	–.059	– 7 18 13.34	...	...	...	–0.04
ε Sagittæ . . .	19 31 37.915	...	–.055	...	+16 10 59.39	...	+0.96	...	...
B. A. C. 6737 .	19 33 26.425	...	+.205	...	+63 9 23.13	...	+0.33	...	...
β Sagittæ . . .	19 35 26.123	...	–.055	...	+17 11 15.79	...	–0.23	...	...
Piazzi, XIX. 243	19 38 2.579	...	...	...	–32 12 28.83	...	...	...	...
ζ Sagittæ . . .	19 43 25.747	...	+.050	...	+18 49 47.16	...	+0.12	...	...
e Draconis . .	20 0 8.911	...	–.031	...	+64 28 17.03	...	–0.87	...	...
B. A. C. 6924 .	20 2 31.001	...	–.013	...	+55 58 50.22	...	...	...	...
20 Vulpeculæ . .	20 6 46.214	...	+.050	...	+26 6 24.62	...	+0.25	...	...
ρ Aquilæ . . .	20 8 29.595	...	–.102	...	+14 49 4.62	...	+0.92	...	...
α^1 Capricorni . .	20 10 43.139	–.038	...	–.020	–12 53 34.97	+0.04	...	...	+0.18
α^2 Capricorni . .	20 11 7.084	+.006	...	+.007	–12 55 51.99	+1.02	...	+1.03	+1.12
β Capricorni . .	20 13 59.260	–.028	...	–.035	–15 10 28.54	–0.31	...	...	–0.16
B. A. C. 7008 .	20 15 43.451	...	–.043	...	+39 0 36.13	...	–0.22	...	...
π Capricorni . .	20 20 9.908	...	...	–.002	–18 37 12.33	...	...	+0.11	+0.09
ρ Capricorni . .	20 21 43.770	+.007	...	–.008	–18 13 31.35	–0.19	...	...	–0.19
41 Cygni . . .	20 24 17.349	...	–.008	...	+29 57 9.58	...	–0.24	...	...
ζ Delphini. . .	20 29 27.845	...	–.052	...	+14 14 39.01	...	+0.52	...	...
Groom. 3241 .	20 30 31.863	...	...	...	+72 6 29.32	...	...	–0.23	–0.23
μ Aquarii . . .	20 45 54.693	...	...	–.045	– 9 27 4.10	...	...	+0.11	+0.11
Piazzi, XX. 429(seq)?	20 54 29.921	...	...	...	+49 58 38.28	...	...	...	...
η Capricorni . .	20 57 17.378	...	...	–.051	–20 20 52.77	...	...	...	–0.48
γ Equulei . . .	21 4 15.767	...	...	...	+ 9 37 45.01	...	...	...	...
σ Cygni . . .	21 12 30.470	...	–.067	...	+38 52 17.31	...	+0.10	–0.09	...
b Capricorni . .	21 21 35.596	...	...	...	–22 21 2.23	...	...	...	...
ρ Cygni . . .	21 29 16.847	...	+.003	...	+45 2 23.78	...	–0.59	...	...
ξ Aquarii . . .	21 31 5.817	...	...	–.005	– 8 24 49.18	...	...	–0.54	–0.54
γ Capricorni . .	21 33 9.835	–.009	...	–.022	–17 13 32.48	–0.81	...	...	–0.49
κ Capricorni . .	21 35 40.593	...	...	–.052	–19 26 5.92	...	...	...	–0.49
δ Capricorni . .	21 40 8.418	–.018	...	+.013	–16 41 36.70	–0.25	...	...	–0.42
14 Pegasi . . .	21 44 18.994	...	–.080	...	+29 35 35.10	...	–0.56	...	...
μ Capricorni . .	21 46 28.815	...	...	–.037	–14 8 20.83	...	...	–0.67	–0.67
Piazzi, XXI. 336	21 48 54.419	...	–.020	...	+55 37 25.50	...	+0.18	+0.04	...
13 Cephei . . .	21 50 41.170	...	+.004	...	+56 1 11.11	...	–0.32	...	...
79 Draconis . .	21 51 18.660	...	...	...	+73 6 39.95	...	...	+0.07	+0.08
η Piscis Austr. .	21 53 39.148	...	...	...	–29 3 9.95	...	...	...	...
o Aquarii . . .	21 56 50.952	...	...	...	– 2 45 29.27	...	...	...	...
1 H. Lacertæ . .	22 8 30.948	...	–.131	...	+39 5 42.90	...	+0.21	+0.29	...

NAME OF STAR.	Right Ascensions for 1875.0.	Auwers *minus* H. C. O.	Safford *minus* H. C. O.	Newcomb *minus* H. C. O.	Declinations for 1875.0.	Auwers *minus* H. C. O.	Safford *minus* H. C. O.	Boss *minus* H. C. O.	Newcomb *minus* H. C. O.
	h. m. s.	s.	s.	s.	° ′ ″	″	″	″	″
ρ Aquarii . . .	22 13 37.255	. . .	. . .	+.010	− 8 26 53.90	. . .	. . .	. . .	+1.04
B. A. C. 7803 .	22 16 41.750	. . .	−.040	. . .	+43 6 57.01	. . .	+0.04	. . .	. . .
π Aquarii . . .	22 18 53.569	. . .	. . .	−.027	+ 0 44 36.65	. . .	. . .	+0.80	+0.79
ζ Aquarii med. .	22 22 23.723	. . .	. . .	. . .	− 0 39 32.91	. . .	. . .	. . .	. . .
β Piscis Austr. .	22 24 23.653	. . .	. . .	. . .	−32 59 11.36	. . .	. . .	. . .	. . .
226 B. Cephei . .	22 30 4.184	. . .	. . .	. . .	+75 34 56.29	. . .	. . .	+0.31	+0.31
ε Piscis Austr. .	22 33 44.346	. . .	. . .	. . .	−27 41 42.81	. . .	. . .	. . .	. . .
δ Aquarii . . .	22 48 0.927	−.037	. . .	. . .	−16 29 6.96	+0.25	. . .	. . .	. . .
α Piscis Austr. .	22 50 44.396	−.014	. . .	−.019	−30 17 3.52	−0.53	. . .	−0.35	−0.36
Piazzi, XXII. 262	22 52 45.342	. . .	. . .	. . .	−30 7 54.46	. . .	. . .	. . .	. . .
55 Pegasi . . .	23 0 42.481	. . .	. . .	. . .	+ 8 44 4.00	. . .	. . .	. . .	. . .
c^2 Aquarii . . .	23 2 46.808	+.017	. . .	. . .	−21 51 2.93	+0.53	. . .	. . .	. . .
59 Pegasi . . .	23 5 25.571	. . .	. . .	. . .	+ 8 2 29.32	. . .	. . .	. . .	. . .
φ Aquarii . . .	23 7 50.929	. . .	. . .	. . .	− 6 43 21.32	. . .	. . .	. . .	. . .
ψ^3 Aquarii . . .	23 12 27.548	. . .	. . .	−.017	−10 17 39.49	. . .	. . .	. . .	+1.28
o Cephei . . .	23 13 29.972	. . .	+.061	. . .	+67 25 40.04	. . .	+0.13	+0.31	+0.31
b^1 Aquarii . . .	23 16 24.228	. . .	. . .	. . .	−20 46 58.52	. . .	. . .	. . .	. . .
θ Piscium . . .	23 21 37.677	. . .	. . .	−.016	+ 5 41 33.16	. . .	. . .	−0.31	−0.32
b^3 Aquarii . . .	23 26 44.012	. . .	. . .	. . .	−21 36 19.16	. . .	. . .	. . .	. . .
15 Andromedæ .	23 28 30.861	. . .	. . .	. . .	+39 32 49.88	. . .	. . .	. . .	. . .
ι^1 Aquarii . . .	23 37 43.014	. . .	. . .	. . .	−18 58 14.19	. . .	. . .	. . .	. . .
ψ Andromedæ .	23 39 50.685	. . .	−.002	. . .	+45 43 34.22	. . .	+0.48	. . .	. . .
δ Sculptoris . .	23 42 24.703	+.011	. . .	. . .	−28 49 17.03	−0.59	. . .	. . .	. . .
Piazzi, XXIII. 204	23 44 8.030	. . .	−.068	. . .	+50 55 38.07	. . .	+1.52	. . .	. . .
Groom. 4163 .	23 48 46.199	. . .	. . .	. . .	+73 42 51.86	. . .	. . .	+1.29	+1.29
Piazzi, XXIII. 237	23 50 50.956	. . .	−.117	. . .	+55 0 36.81	. . .	+1.25	. . .	. . .
30 Piscium . . .	23 55 32.926	. . .	. . .	+.029	− 6 42 32.08	. . .	. . .	. . .	+0.10
2 Ceti	23 57 20.130	. . .	. . .	. . .	−18 1 55.09	. . .	. . .	. . .	. . .
33 Piscium . . .	23 58 56.229	. . .	. . .	+.014	− 6 24 24.93	. . .	. . .	. . .	+0.27

It will be seen that the deviations of the positions of both the Primary and the Secondary catalogues from the system of Auwers are well distributed, whatever the extent or the order of the combination of the residuals which may be chosen. This distribution is not quite so well effected in the comparisons with Safford, Boss, and Newcomb; first, because it is based upon a less number of stars, and second, because it involves the determination of the systematic relation between three catalogues instead of two. These relations are exhibited in the following tables:—

RESIDUALS ARRANGED IN THE ORDER OF RIGHT ASCENSION.

All the stars between −10° and +60° declination are included in this comparison except η Cassiopeiæ, θ Draconis, η Draconis, Groombridge 2377, and b Draconis.

PRIMARY CATALOGUE.

Auwers *minus* H. C. O.		Safford *minus* H. C. O.		Newcomb *minus* H. C. O.	
No. Stars.	$\Delta\alpha$	No. Stars.	$\Delta\alpha$	No. Stars.	$\Delta\alpha$
In groups of One Hour.					
	s.		s.		s.
9	−.002	6	+.027	5	+.000
9	+.004	6	−.011	6	−.006
15	+.000	..	....	5	−.013
13	−.002	..	....	8	−.003
14	+.000	..	....	7	−.006
14	−.001	..	....	6	+.007
6	−.002	..	....	4	+.003
11	+.000	..	....	7	+.006
8	+.008	..	....	4	−.021
10	+.002	..	....	6	−.002
10	+.002	..	....	5	+.003
10	−.006	..	....	7	+.003
5	+.007	3	−.001	3	+.021
7	+.001	4	+.017	4	+.005
10	−.005	9	−.004	4	+.011
12	+.007	8	−.006	4	+.021
11	−.006	7	+.000	3	−.005
7	−.003	7	+.008	5	+.006
9	+.011	8	+.002	4	+.017
9	−.004	5	+.016	4	−.001
9	+.003	8	+.001	4	+.010
8	−.013	5	−.013	5	−.012
16	−.001	11	−.010	5	+.004
8	+.013	8	+.047	2	+.010
Means	+.000	..	+.004	..	+.002
In groups of Two Hours.					
	s.		s.		s.
18	+.001	12	+.008	11	−.003
28	−.001	..	....	13	−.007
28	−.001	..	....	13	+.000
17	−.001	..	....	11	+.005
18	+.005	..	....	10	−.010
20	−.002	..	....	12	+.003
12	+.004	17	+.009	7	+.012
22	+.001	17	−.005	8	+.016
18	−.005	14	+.004	8	+.002
18	+.003	13	+.007	8	+.008
17	−.005	13	−.004	9	−.002
24	+.004	19	+.014	7	+.006
Means	+.000	..	+.004	..	+.002
In groups of Three Hours.					
	s.		s.		s.
33	+.001	..	....	16	−.006
41	−.001	..	....	21	−.001
25	+.002	..	....	15	−.002
30	−.001	..	....	18	+.001
22	+.000	16	+.002	11	+.012
30	+.000	22	+.000	12	+.008
27	+.003	21	+.005	12	+.009
32	+.000	24	+.008	12	−.002
Means	+.000	..	+.004	..	+.002
In groups of Four Hours.					
	s.		s.		s.
46	+.000	..	....	24	−.005
45	−.001	..	....	24	+.002
38	+.001	..	....	22	−.003
34	+.002	34	+.002	15	+.014
36	−.001	27	+.005	16	+.005
41	+.001	32	+.007	16	+.002
Means	+.000	..	+.004	..	+.002
In groups of Six Hours.					
	s.		s.		s.
74	+.000	..	....	37	−.003
55	+.000	..	....	33	+.000
52	+.000	38	+.001	23	+.010
59	+.001	45	+.007	12	+.003
Means	+.000	..	+.004	..	+.001

RESIDUALS ARRANGED IN THE ORDER OF DECLINATION.

Limits in Right Ascension.	Auwers *minus* H. C. O.			Safford *minus* H. C. O.			Newcomb *minus* H. C. O.			Boss *minus* H. C. O.	
	No. Stars	Δα	Δδ	No. Stars.	Δα	Δδ	No. Stars.	Δα	Δδ	No. Stars.	Δδ
−10° . . . +5°											
h. h.		s.	"		s	"		s.	"		"
0 . . . 6	19	−.001	+.06	. .	. . . .	. . .	9	−.007	−.03	6	+.03
6 . . . 12	4	+.004	+.06	. .	. . . .	. . .	3	+.003	−.23	3	+.00
12 . . . 18	12	+.007	+.12	. .	. . . .	. . .	8	+.014	+.13	7	+.13
18 . . . 24	12	−.008	−.10	. .	. . . .	. . .	8	−.005	−.13	9	−.04
Means. . .	. .	+.000	+.04	. .	. . . .	. . .	. .	+.001	+.03	. .	+.03
+5° . . . +20°											
h. h		s	"		s	"		s.	"		"
0 . . . 6	16	+.003	+.02	. .	. . . .	. . .	14	+.003	+.09	14	+.09
6 . . . 12	19	+.005	+.02	. .	. . .	. .	16	−.001	−.07	11	+.17
12 . . 18	14	−.004	−.05	12	−.004	+.01	6	+.008	+.10	8	+.08
18 . . . 24	16	+.002	+.04	11	+.003	+.27	9	+.008	+.02	12	+.01
Means. . .	. .	+.002	+.01	. .	+.000	+.13	. .	+.003	+.02	. .	+.09
+20° . . . +35°											
h. h		s.	"		s.	"		s.	"		"
0 . . . 6	16	−.001	−.07	5	+.009	+.27	11	−.015	−.10	11	+.01
6 . . . 12	16	−.007	−.02	. .	. . . .	. . .	10	+.002	−.18	11	+.06
12 . . . 18	10	+.007	+.05	10	+.012	−.01	3	+.021	−.09	8	−.06
18 . . . 24	14	+.007	−.06	14	+.003	−.04	2	+.016	−.18	11	−.08
Means. . .	. .	+.001	−.03	. .	+.007	+.02	. .	−.002	−.14	. .	−.01
+35° . . . +50°											
h. h.		s.	"		s	"		s.	"		"
0 . . . 6	16	−.003	+.01	3	−.003	+.27	3	+.008	+.13	11	−.03
6 . . . 12	12	+.000	+.11	. .	. . . .	. . .	. .	. . . .	. . .	9	+.14
12 . . . 18	9	−.003	−.18	9	−.005	−.23	4	−.006	−.34	7	−.26
18 . . . 24	12	−.004	+.00	12	+.001	−.08	5	+.001	+.06	9	+.11
Means. . .	. .	−.003	+.00	. .	−.002	−.09	. .	+.000	−.06	. .	+.00
+50° . . . +65°											
h. h.		s.	"		s	"		s.	"		"
0 . . . 6	11	−.008	+.07	4	+.000	+.12	2	+.029	−.04	7	+.24
6 . . . 12	5	−.007	+.01	. .	. . . .	. . .	. .	. . . .	. . .	3	−.13
12 . . 18	10	−.003	−.02	10	+.005	+.03	3	+.009	−.01	10	−.05
18 . . . 24	7	+.019	+.02	7	+.018	+.18	. .	. . . .	. . .	5	+.09
Means. . .	. .	−.001	+.02	. .	+.008	+.10	. .	+.017	−.02	. .	+.05
+65° . . . +80°											
h. h.		s.	"		s.	"		s.	"		"
0 . . . 6	18	−.004	+.09	2	−.067	+.19	7	. . . .	−.06	9	−.22
6 . . . 12	18	−.017	−.02	. .	. . . .	. . .	6	. . . .	−.18	6	−.18
12 . . . 18	19	−.014	−.05	7	+.007	−.14	8	. . . .	−.15	10	+.23
18 . . . 24	20	+.002	−.01	5	−.034	+.13	9	. . . .	+.08	11	+.08
Means. . .	. .	−.008	+.00	. .	−.018	+.00	. .	. . . .	−.07	. .	+.00

Secondary Catalogue.

Limits in δ	Auwers *minus* H. C. O.		Safford *minus* H. C. O.		Newcomb *minus* H. C. O.		Boss *minus* H. C. O.
	$\Delta\alpha$	$\Delta\delta$	$\Delta\alpha$	$\Delta\delta$	$\Delta\alpha$	$\Delta\delta$	$\Delta\delta$
° °	s.	″	s.	″	s.	″	″
−30 . . . − 5	+.000	+.00	. . . .	. . .	+.006	−.18	−.18
− 5 . . . +20	. . . .	. . .	−.019	−.03	−.012	−.33	−.06
+20 . . . +45	. . . .	. . .	−.023	+.02	+.001	+.04	+.14
+45 . . . +70	. . . .	. . .	−.015	+.08	. . . .	−.05	−.05
+70 . . . +85	. . . .	. . .	. . . .	. . .	. . . .	+.36	+.22

The extraordinary agreement of the reduced positions of Safford, Newcomb, and Boss, especially in declination, with the Normal System, will not escape attention. It cannot be expected that any single catalogue will exhibit the same degree of agreement, especially if, as is the case with the Harvard College Catalogue, it has been constructed from observations made subsequent to those upon which the Normal System is founded. It is probable therefore that in a majority of the cases in which the deviations from the normal system are large, the residuals represent accidental errors of observation in the present catalogue.

To this class *probably* belong the following stars:—

In Right Ascension.	In Declination.	
c Persei.	55 Cassiopeiæ.	4 Ursæ Minoris.
o^1 Eridani.	67 Ceti.	109 Virginis.
10 Camelopardi.	Groombridge 716.	δ Bootis.
η Leonis.	9 H. Camelopardi.	δ Aquilæ.
ξ Ursæ Majoris, med.	Groombridge 848.	ν Cygni.
γ Virginis.	12 Canum Venaticorum, seq.	β Aquarii.
Groombridge 2415.		

On the other hand, I shall be disappointed if future observations do not confirm the substantial accuracy of the values given for the right ascensions of the following stars, viz.; Groombridge 29, η Cassiopeiæ, 36 Camelopardi, 1 H. Draconis, Groombridge 2164, θ Draconis, η Draconis, Groombridge 2377, b Draconis, β Lyræ (perhaps), Groombridge 2900, and υ Pegasi. The discussion of positions which are apparently erroneous will be reserved for another paper. It will, however, be instructive to record the present state of the testimony with respect to these stars as given in the discussion of Dr. Auwers, to which are added the positions from this catalogue instead of the places taken from Vol. X. of the Annals. Both coördinates are for 1875.0.

LIST OF STARS EXHIBITING A DISCORDANCE IN RIGHT ASCENSION.

STAR.	PULKOWA.			GREENWICH.		H. C. O.
	1865.	1871.	1845.	1861.	1872.	1875.
	h. m. s.	s.	s.	s.	s.	s.
Gr. 29 = B 2.6	0 9	10.298	. . . .	9.969	10.217	10.378
η Cassiopeiæ . .	0 41 32.841	. . . .	32.762	32.815	32.949	32.938
c Persei . . .	3 59 35.568	. . . .	35.544	35.429	. . . .	35.605
o¹ Eridani . . .	4 5	45.926	. . . .	45.873	45.890	45.850
10 Camelop. . .	4 52 18.386	. . . .	18.363	18.448	18.379	18.318
36 Camelop. . .	6 0	16.488	. . . .	16.281	16.448	16.531
1 H. Draconis .	9 19 5.801	. . . .	5.620	5.749	5.605	5.932
η Leonis . . .	10 0 30.991	. . . .	31.031	31.008	30.973	30.942
ξ Ursæ Majoris .	11 11 30.680	. . . .	30.594	30.629	30.742	30.709
γ Virginis . . .	12 35 19.635	. . . .	19.626	19.634	19.591	19.567
Groom. 2164 .	14 48	16.068	16.080	16.036	. . . .	16.196
θ Draconis . .	15 59 32.979	. . . .	33.082	33.074	33.065	32.928
η Draconis . .	16 22 18.166	. . . .	18.328	18.273	18.133	18.077
Groom. 2377 .	16 42	55.724	55.854	55.720	55.705	55.637
Groom. 2415 .	17 3	42.146	. . . .	. . . .	. . . .	42.190
β Lyræ	18 45 27.928	. . . .	27.923	27.942	27.920	27.840
Groom. 2900 .	19 29	12.997	. . . .	. . . .	12.747	13.082
υ Pegasi . . .	23 19	8.530	. . . .	8.472	8.547	8.428

LIST OF STARS EXHIBITING A DISCORDANCE IN DECLINATION.

STAR.	R.A.	PULKOWA.			GREENWICH.		LEIPSIG.	LEIDEN.	H. C. O.
		1865.	1871.	1845.	1861.	1872.	1868.	1868.	1875.
	h. m.	° ′ ″	″	″	″	″	″	″	″
55 Cassiopeiæ . .	2 5	+65 56 . . .	13.21	. . .	13.30	12.22	. . .	. . .	11.37
67 Ceti	2 11	− 6 59 . . .	55.76	. . .	57.55	57.33	57.02	. . .	58.57
Groom. 716 . .	3 31	+62 48 . . .	32.32	. . .	32.78	32.32	32.26	. . .	33.52
9 H. Camelop. .	3 46	+60 44 . . .	24.09	. . .	24.43	24.26	26.22	. . .	23.26
Groom. 848 .	4 32	+75 42 . . .	32.70	. . .	32.53	32.60	. . .	. . .	31.35
12 Can. Ven. . .	12 50	+38 59 37.88	. . .	37.83	38.05	37.59	37.82	37.63	39.21
4 Ursæ Minoris .	14 9	+78 8 . . .	5.48	. . .	6.90	5.45	. . .	. . .	7.23
109 Virginis . . .	14 40	+ 2 25 15.34	. . .	14.72	14.64	. . .	. . .	. . .	13.49
δ Bootis . . .	15 10	+33 46 55.99	. . .	56.24	55.96	55.83	. . .	. . .	55.11
δ Aquilæ . . .	19 19	+ 2 52 1.36	. . .	1.41	1.50	1.28	0.89	1.67	2.56
ν Cygni . . .	20 52	+40 41 12.33	. . .	12.35	12.12	. . .	. . .	. . .	11.08
β Aquarii . . .	21 25	− 6 7 12.40	. . .	12.46	12.81	12.81	11.96	12.53	10.83

COMPARISON OF THE FOUR CATALOGUES UNDER CONSIDERATION BY MEANS OF THEIR PROPER MOTIONS.

Since the proper motion is a direct function of the time, it is possible to determine the exact amount by which two catalogues will differ at the expiration of a given time. If the two systems of proper motions differ systematically, these systematic errors will be introduced into the catalogues themselves. In general, the constant part of the deviation may be considered as a function of the precession constant. The explanation of the variable part in any given case is for the most part exceedingly difficult. For example: it is easy to account for the systematic deviations between Auwers and Boss, by referring them to the corresponding deviations between the system of Bradley on the one hand and the mean of the systems of Bessel, Struve, and Argelander on the other, but I have found it impossible to trace the origin of the differences between these fundamental systems. I give below the comparison of each authority with Auwers. Columns I. and II. contain the values of $\Delta\mu$ and $\Delta\mu'$ for the first and the second twelve hours of right ascension respectively. The proper motions of the secondary catalogue form the basis of the comparison in the Harvard College Observations; the corresponding values were communicated by Dr. Auwers to Professor Pickering for facilitating the reductions in Vol. XII. of the Annals. In the comparison with Safford in right ascension, $\Delta\mu$ involves the change from the constants of Bessel to those of Struve. I have assumed the mean value to be the constant part of the deviation.

AUWERS *minus* HARVARD COLLEGE.

Limits in δ	$\Delta\mu$	I.	II.	Number Stars.	$\Delta\mu'$	I.	II.	Number Stars.
° °	s.	s.	s.		″	″	″	
−31 . . . −20	−.00033	−.00020	−.00049	41	+.0018	+.0014	+.0021	40
−20 . . . −10	−.00032	−.00019	−.00039	44	+.0039	+.0045	+.0029	42
−10 . . . + 0	−.00030	−.00023	−.00038	24	+.0030	+.0020	+.0041	23
+ 0 . . . +10	−.00018	−.00006	−.00031	18	+.0014	+.0008	+.0015	18
+10 . . . +20	−.00017	+.00000	−.00031	19	+.0012	+.0022	+.0003	19
+20 . . . +30	−.00011	+.00003	−.00023	18	−.0008	+.0005	−.0024	17
+30 . . . +40	−.00023	−.00052	+.00000	9	+.0018	−.0012	+.0042	21
+40 . . . +50	−.00010	+.00003	−.00026	11	+.0019	+.0030	+.0008	11
+50 . . . +70	+.00045	+.00052	+.00038	8	+.0001	−.0002	+.0005	8
Means . . .	−.00014	−.00007	−.00022	. .	+.0016	+.0014	+.0016	. .

AUWERS *minus* SAFFORD.

Limits in δ	Δμ	I.	II.	Number Stars.	Δμ′	I.	II.	Number Stars.
	s.	s.	s.		″	″	″	
Const. =	−.00222	−.00235	−.00210					
+10° ... +20°	+.00018	+.00025	−.00010	36	−.0006	−.0007	−.0005	36
+20 ... +30	−.00052	+.00005	−.00090	35	+.0020	+.0012	+.0024	35
+30 ... +40	+.00038	+.00085	+.00010	28	+.0074	+.0076	+.0073	28
+40 ... +50	−.00082	−.00045	−.00120	33	−.0034	−.0050	−.0018	33
+50 ... +60	−.00072	−.00075	−.00080	33	+.0033	+.0020	+.0050	33
+60 ... +70	+.00148	+.00015	+.00290	28	+.0005	+.0006	+.0004	28
Means . . .	−.00222	−.00235	−.00210	. .	+.0015	+.0010	+·0021	. .

AUWERS *minus* NEWCOMB.

Limits in δ	Δμ	I.	II.	Number Stars.	Δμ′	I.	II.	Number Stars.
−30 ... −20	−.00084	−.00108	−.00063	13	+.0126	+.0140	+.0114	13
−20 ... −10	−.00100	−.00098	−.00102	25	+.0147	+.0128	+.0165	25
−10 ... + 0	−.00103	−.00087	−.00116	20	+.0079	+.0078	+.0080	20
+ 0 ... +10	−.00108	−.00122	−.00094	30	+.0138	+.0166	+.0112	30
+10 ... +20	−.00083	−.00104	−.00064	30	+.0123	+.0107	+.0137	30
+20 ... +30	−.00085	−.00091	−.00084	26	+.0096	+.0087	+.0106	26
+30 ... +40	−.00071	+.00012	−.00153	12	+.0182	+.0208	+.0157	12
+40 ... +50	−.00057	−.00078	−.00040	9	+.0062	−.0015	+.0124	9
+50 ... +60	−.00113	−.00090	−.00137	6	+.0043	+.0027	+.0060	6
+60 ... +70	−.00101	+.00020	−.00242	13	−.0035	−.0006	−.0070	13
[+70 ... +85	−.00349	−.00382	−.00317]	20	−.0027	−.0003	−.0051	20
Means. . .	−.00091	−.00075	−.00110	. .	+.0085	+.0083	+.0085	. .

AUWERS *minus* BOSS.

Limits in δ	Δμ′	I.	II.	Number Stars.
	″	″	″	
−30° ... −20°	+.0097	+.0090	+.0102	9
−20 ... −10	+.0137	+.0140	+.0136	9
−10 ... + 0	+.0094	+.0113	+.0081	17
+ 0 ... +10	+.0154	+.0155	+.0150	27
+10 ... +20	+.0122	+.0137	+.0110	31
+20 ... +30	+.0105	+.0120	+.0085	37
+30 ... +40	+.0167	+.0188	+.0157	35
+40 ... +50	+.0047	+.0077	+.0015	41
+50 ... +60	+.0020	+.0045	−.0005	. .
+60 ... +70	−.0022	−.0032	−.0013	. .
+70 ... +85	−.0043	−.0030	−.0050	. .
Means	+.0080	+.0091	+.0070	. .

Comparing the deviations between the different systems in a century, we have the following results: —

CATALOGUES.	Maximum mean Deviation in a Century.		Maximum systematic Deviation in a Century.	
	$\Delta\alpha$	$\Delta\delta$	$\Delta\alpha$	$\Delta\delta$
	s.	"	s.	"
Auwers *minus* Harvard College	—.01	+0.2	.08	0.6
Auwers *minus* Safford	—.22	+0.2	.23	1.1
Auwers *minus* Boss	. . .	+0.8	. .	2.1
Auwers *minus* Newcomb	—.09	+0.8	.06	2.2

It will be seen from the foregoing comparison that *if we may consider the system of Auwers as an absolute standard,* three classes of errors will be introduced into any system of observations which depends upon the systems, either of Safford, Boss, or Newcomb. These are: —

(*a*) A constant error which is a direct function of the time.

(*b*) Systematic errors which result from those errors in the proper motion, which are functions either of the right ascension or of the declination, and whose magnitude is proportional to the distance from the assumed common epoch.

(*c*) Errors which will be introduced through the constant *n*, resulting from a change in the relation between the places of the equatorial, and of the polar stars in the fundamental system chosen.

The effect of these errors will be sensible in the following cases: —

CLASS (*a*) Safford in right ascension.
CLASS (*b*) Boss and Newcomb in declination.
CLASS (*c*) Newcomb (Gould) in right ascension.

But there is no *decisive* evidence that the system of Auwers is to be preferred to the system of Newcomb in right ascension (from $\delta = -30^\circ$ to $\delta = +60^\circ$) or to the system of Boss in Declination.

We must therefore conclude that the problem of the construction of a homogeneous system of stellar coördinates which will satisfy all past observations and which future observations may be relied upon to verify, has not yet been completely solved.